

# A comparison of walking ability between the dynamic hip screw and cephalomedullary nailing fixations in intertrochanteric femur fracture



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## ABSTRACT

**Introduction:** Fractures of the hip are common injuries; approximately 50% of fractures occur in the intertrochanteric region. The treatment is to restore patients to their pre-injury level of mobility. Secure fixation is required to allow immediate return to unrestricted weight-bearing. The common fixation methods are dynamic hip screw (DHS) and proximal femoral nail anti-rotation (PFNA). This study compared postoperative walking ability in femoral intertrochanter fractures treated with DHS and PFNA and evaluated the confounding factors.

**Methods:** We conducted a retrospective cross-sectional conducted at Wahidin Sudirohusodo General Hospital and Universitas Hasanuddin Hospital for patients from 2018 to 2021. The sample was patients with intertrochanteric femoral fracture based on x-ray treated with DHS and PFNA using the purposive sampling method. A total of 107 patients with complete medical record data were included in this research, consisting of 81 DHS cases and 26 PFNA cases. Obtained data from these patients were then statistically analyzed by Chi-square and Fischer exact test. The p-value <0.05 was significant.

**Results:** In bivariate analysis, the percentage of weight-bearing subjects was higher in DHS (61.7%) than in PFNA (46.2%), although not statistically significant ( $p > 0.05$ ). By controlling for confounding factors such as age, gender, type of fracture, and length of stay, it turns out that there is no significant difference in the results of the postoperative walking ability comparison.

**Conclusion:** It was concluded that there was no difference in weight-bearing walking ability (full and partial) at discharge between PFNA and DHS.

**Keywords:** intertrochanter, dynamic hip screw, cephalomedullary nailing, walking ability.

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## INTRODUCTION

Fractures of the hip are common injuries, with 50% of fractures occurring in the intertrochanteric region. The prevalence increases exponentially with age and is also associated with a high morbidity and mortality rate. Femoral intertrochanteric or intertrochanteric hip fractures, common in elderly patients, are extracapsular fractures between the femur neck fundus and smaller trochanter. Elderly patients with osteoporosis often have unstable intertrochanteric fractures induced by minor external forces. The following long-time clinotherapy can result in complications such as deep vein thrombosis, hypostatic pneumonia, and bedsores. The incidence and mortality of

the complications (including coxa vara) induced by conservative treatment are as high as 50% and 35%, respectively.<sup>1,2</sup>

Beyond preventing avoidable deaths, the goal of the treatment is to restore patients to their pre-injury level of mobility. In order to allow immediate return to unrestricted weight-bearing, secure fixation is often required. The implants chosen for the operative intervention are mainly categorized into extramedullary and intramedullary. For stable intertrochanteric femoral fracture treatment, a dynamic hip screw (DHS) has been the most widely acceptable implant. However, there still exist controversies over the choice of treatment for unstable intertrochanteric femoral fractures.<sup>2</sup> Proximal femoral nail anti-rotation

(PFNA) provides additional anchoring in cancellous bone and can treat unstable proximal femoral fractures.<sup>1</sup>

This study compared postoperative walking ability in femoral intertrochanter fractures treated with DHS and PFNA. We also evaluate confounding factors that may contribute to the postoperative functional assessment.

## MATERIAL AND METHODS

### Study Design

This study was a retrospective cross-sectional conducted at Wahidin Sudirohusodo General Hospital and Hasanuddin University Hospital for patients from 2018 to 2021

## Population and Subjects

The population was patients with intertrochanteric femoral fracture based on x-ray treated with DHS and PFNA. Subjects for this study were obtained using the purposive sampling method. A total of 107 patients with complete medical record data were included in this research, consisting of 81 DHS cases and 26 PFNA cases. Obtained data from these patients were then statistically analyzed.

## Methods and Analysis

We evaluated medical records data from each patient included in this study. Data obtained included age, sex, BMI, fracture type (stable or unstable), fixation method, length of stay, and discharge walking ability.

BMI was categorized as normal (18.5-24.9) and abnormal. Fracture types were evaluated based on hip x-ray evaluation. Length of stay was categorized early ( $\leq 5$  days) and late ( $> 5$  days)

Obtained data were statistically analyzed with Chi-square and Fischer exact test using SPSS ver. 25. The results served as quantitative data with a narrative explanation. The p-value  $< 0.05$  showed a significant result.

## RESULTS

The characteristics of patient distribution were described as age, gender, and BMI. Based on age, patients were dominated by elderly patients 85 (79.4%). The gender was dominantly by female 62.6%. For BMI distribution, 90 patients (84.1%) have normal BMI, while the others categorized as overweight or obese (Table 1).

Patients fixed with DHS were more dominant for the fixation method (75.7%). We found the most fracture type was unstable (73.8%). While in the length of stay category, we found most of the samples had long length of stay (59.8%) (Table 2).

The percentage of weight-bearing subjects was higher in DHS (61.7%) than in PFNA (46.2%), although not statistically significant ( $p > 0.05$ ) (Table 3). Furthermore, the analysis aimed to compare walking ability between DHS and PFNA by controlling for the influence of sex, age, BMI, fracture type, and length of stay. All the variables showed insignificant

result ( $p > 0.05$ ) (Table 4).

## DISCUSSION

In this study, bivariate analysis was conducted to compare the walking ability of patients undergoing DHS and PFNA surgery. This study found that the ability to walk with weight-bearing was higher in patients undergoing DHS procedures (61.7%) than patients undergoing PFNA procedures (46.2%). However, the results of this study were not significant ( $p = 0.162$ ). The results of this study are inversely proportional to the results of research conducted by Carulli et al., where the ability to walk with weight-bearing patients who underwent PFNA procedures was higher (81.6%) compared to patients who underwent DHS procedures (67.16%).<sup>3</sup> Another study was conducted by Cho et al. to compare outcomes between DHS and PFNA in intertrochanteric femoral fractures in elderly patients. In this study, the ability to walk with weight-bearing in patients undergoing PFNA

procedures was higher (56.8%) compared to patients undergoing DHS procedures (50.4%). However, the results of this study were not statistically significant ( $p = 0.815$ ). Lack of improvement in walking ability despite satisfactory radiological findings is associated with persistent pain from the fracture itself or pain caused by surgery, especially in elderly patients with incomplete improvement in muscle strength, limited walking ability, and low motivation for rehabilitation.<sup>4</sup>

Based on age, in the age group  $< 60$  years, the results of this study showed that the ability to walk with weight-bearing was higher in patients who underwent DHS fixation (87.5%) compared to patients who received PFNA fixation (50%). In the age group 60 years, the ability to walk with weight-bearing was also higher in patients receiving DHS fixation (55.4%) than patients receiving PFNA fixation (45.0%). In the study conducted by Cho et al., the mean age of patients receiving DHS fixation was 84.2 years (range 70-93 years), and the average age of patients receiving

**Table 1. Sample Characteristics.**

Variable		n	%
Sex	Male	40	37.4
	Female	67	62.6
Age	$< 60$ years old	22	20.6
	$\geq 60$ years old	85	79.4
BMI	Normal	90	84.1
	OW-Obese	17	15.9

**Table 2. Clinical characteristics.**

	Variable	n	%
Fixation Methods	DHS	81	75.7
	PDF	26	24.3
Fracture type	Stable	28	26.2
	Unstable	79	73.8
Walking Ability	Weight-bearing	62	57.9
	Non-Weight-bearing	45	42.1
Length of Stay	Short	43	40.2
	Long	64	59.8

**Table 3. Comparison of Walking Ability by Method of Fixation.**

Walking ability		Methods		Total	p
		DHS	PDF		
Weight-bearing	n	50	12	62	0.162
	%	61.7%	46.2%	57.9%	
Non-Weight-bearing	n	31	14	45	
	%	38.3%	53.8%	42.1%	
Total	n	81	26	107	
	%	100.0%	100.0%	100.0%	

PFNA fixation was 81 years (range 70-94 years). Gait was higher in the group with PFNA fixation (56.8%) than patients receiving DHS fixation, but this result was not significant ( $p = 0.8$ ). The reduced ability to walk is influenced by improving

muscle strength, limited walking ability, and low rehabilitation motivation, especially in elderly patients. Trochanteric fractures are more common in elderly patients with osteoporosis and the ability to walk and poor health conditions that

will cause a decrease in walking ability and quality of daily life in elderly patients.<sup>4</sup>

Based on gender, the ability to walk with weight-bearing in the male patient group was higher in patients receiving DHS fixation (70%) compared to

**Table 4. Comparison of Walking Ability based on variables to Fixation Method.**

Variables	Walking ability	Method		Total	p	
		DHS	PDF			
Age		n	14	3	17	
<60	Weight-bearing	%	87.5%	50.0%	77.3%	0.100
	Non-Weight-bearing	n	2	3	5	
>=60	Weight-bearing	%	12.5%	50.0%	22.7%	0.416
	Non-Weight-bearing	n	36	9	45	
Sex	Weight-bearing	%	55.4%	45.0%	52.9%	0.176
	Non-Weight-bearing	n	29	11	40	
Male	Weight-bearing	%	44.6%	55.0%	47.1%	0.700
	Non-Weight-bearing	n	21	6	27	
Female	Weight-bearing	%	70.0%	60.0%	67.5%	0.176
	Non-Weight-bearing	n	9	4	13	
BMI	Weight-bearing	%	30.0%	40.0%	32.5%	0.584
	Non-Weight-bearing	n	29	6	35	
Normal	Weight-bearing	%	56.9%	37.5%	52.2%	0.062
	Non-Weight-bearing	n	22	10	32	
OW/Obese	Weight-bearing	%	43.1%	62.5%	47.8%	0.584
	Non-Weight-bearing	n	46	10	56	
Length of Stay	Weight-bearing	%	67.6%	45.5%	62.2%	0.187
	Non-Weight-bearing	n	22	12	34	
Short	Weight-bearing	%	32.4%	54.5%	37.8%	0.490
	Non-Weight-bearing	n	4	2	6	
Long	Weight-bearing	%	30.8%	50.0%	35.3%	0.161
	Non-Weight-bearing	n	9	2	11	
Fracture Type	Weight-bearing	%	69.2%	50.0%	64.7%	1.000
	Non-Weight-bearing	n	19	4	23	
Stable	Weight-bearing	%	59.4%	36.4%	53.5%	0.161
	Non-Weight-bearing	n	13	7	20	
Unstable	Weight-bearing	%	40.6%	63.6%	46.5%	0.490
	Non-Weight-bearing	n	31	8	39	
Stable	Weight-bearing	%	63.3%	53.3%	60.9%	0.161
	Non-Weight-bearing	n	18	7	25	
Unstable	Weight-bearing	%	36.7%	46.7%	39.1%	1.000
	Non-Weight-bearing	n	16	2	18	
Stable	Weight-bearing	%	64.0%	66.7%	64.3%	0.161
	Non-Weight-bearing	n	9	1	10	
Unstable	Weight-bearing	%	36.0%	33.3%	35.7%	0.161
	Non-Weight-bearing	n	34	10	44	
Fracture Type	Weight-bearing	%	60.7%	43.5%	55.7%	0.161
	Non-Weight-bearing	n	22	13	35	
Stable	Weight-bearing	%	39.3%	56.5%	44.3%	0.161
	Non-Weight-bearing	n	22	13	35	

Note: BMI: Body Mass Index; OW: overweight

patients receiving PFNA fixation (60%). Meanwhile, in the female patient group, the ability to walk with weight-bearing was higher in patients who received DHS fixation (56.9%) than patients who received PFNA fixation (37.5%). However, these two results were not statistically significant ( $p$ -values 0.700 and 0.176, respectively). Li et al. compared outcomes between PFNA and DHS in elderly patients with intertrochanteric fractures and osteoporosis. This study found that both men and women who received PFNA fixation had better walking ability than patients who received DHS fixation. Various factors can affect the patient's ability to walk, one of which is the condition of osteoporosis. Osteoporosis is common in older women. With the increasing age group, osteoporosis also increases, and fracture is one of the complications of osteoporosis. This condition affects the ability to walk in women.<sup>5</sup>

In patients with normal BMI, the ability to walk with weight-bearing was higher in patients who received DHS fixation (67.6%) compared to the group of patients who received PFNA fixation (45.5%). However, the results of this study were not significant ( $p=0.062$ ). Meanwhile, in the group of patients with overweight or obese BMI, the ability to walk with weight-bearing was higher in the group of patients who received PFNA fixation (50.0%) compared to the group of patients who received DHS fixation (30.8%), but the results of this study did not significant ( $p=0.584$ ). A study by Kristensen et al. that examined the return of walking ability and pre-injury Gait in patients with hip fractures showed that in patients with normal BMI, postoperative walking ability returned to normal in 48.9% of cases compared with 48.0% of cases with abnormal BMI.<sup>6</sup>

In patients with stable fractures, the walking ability of patients undergoing PFNA procedures was higher (66.7%) compared to patients undergoing DHS procedures (64.0%), but this result was not statistically significant ( $p=1.000$ ). This result is in line with the study by Carulli et al. A prospective study was conducted on 140 patients with stable or unstable intertrochanteric fractures undergoing

PFNA or DHS insertion. The walking ability of patients who underwent PFNA insertion was higher (100%) than patients who underwent DHS implantation (63.76%). PFNA is designed to overcome the limitations of extramedullary implants. PFNA theoretically has high biomechanical effectiveness for unstable fractures, minimal soft tissue and vascular damage. Also, PFNA has intrinsic mechanics and a solid load distribution that allows the implant to withstand most of the forces acting on the hip during walking (axial weight-bearing) to avoid stress at the fracture site.<sup>3</sup> In patients with unstable fractures, our results showed higher walking ability in patients undergoing DHS procedures (60.7%) than patients undergoing PFNA procedures (43.5%). The results of this study are in line with the research conducted by Kandel et al., which compared DHS and PFNA in patients with unstable intertrochanteric fractures. In that study, the functional outcome of patients with DHS fixation was higher (89%) than patients who received PFNA fixation (86%), but the results of the study were not significant ( $p>0.05$ ).<sup>7</sup>

Based on the length of stay, in the group of patients with treatment  $<5$  days, the ability to walk was higher in patients who received DHS (59.4%) compared to patients who received PFNA (36.4%). In the group of patients with a length of stay  $>5$  days, walking ability was higher in the DHS group (63.3%) compared to the PFNA group (53.3%). Both of these results were not statistically significant ( $p>0.05$ ). Oba et al. investigated factors affecting postoperative walking ability in hip fracture patients. The ability to walk on discharge was categorized into: walking unaided, walking with a cane, walking with a walker, walking on parallel bars, wheelchair, and bedridden ( $n$  [%]; 28 [6.9], 136 [33], 100 [24], 49 [12], 79 [19] and 17 [4.2]). One hundred and sixty-four of the 409 (40%) patients could walk unaided or with a cane independently on discharge. In bivariate analysis, patients who were unable to walk unaided or with a cane on discharge had the following characteristics: older age, dementia, use of a cane before the injury, a higher proportion of trochanteric fractures, and

lower serum hemoglobin and albumin levels at baseline. Enter. However, there were no significant differences in gender, interval until surgery and length of stay between patients who walked unaided or with a cane and those who did not. The study by Kristensen et al. examined the return of walking ability and pre-injury walking ability in patients with hip fractures. It was found that, on average, a longer length of stay was associated with poorer postoperative walking ability than patients with a shorter length of stay.<sup>6</sup>

## CONCLUSION

This study compared postoperative walking ability in femoral intertrochanter fractures treated with DHS and PFNA. It was concluded that there was no significant difference in weight-bearing walking ability (full and partial) at discharge between PFNA and DHS. By controlling for confounding factors such as age, gender, type of fracture, and length of stay, it turns out that there is no difference in the results of the postoperative walking ability comparison.

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## ETHICAL CONSIDERATION

The ethic commission of Universitas Hassanudin General Hospital has approved this study with letter number: 694/UN4.6.4.5.31/PP36/2021.

## AUTHOR CONTRIBUTION

KTB contributed in concepts, design, definition of intellectual content, manuscript preparation, and guarantor. IAP contributed in data acquisition, data analysis, statistical analysis, and manuscript review. HSA contributed in concepts, design, literature search, clinical studies, experimental studies, and manuscript editing. LTP contributed in literature search, clinical studies, experimental studies, and manuscript editing. JK contributed in literature search, clinical studies, experimental studies, and manuscript editing.

**CONFLICT OF INTEREST**

All named authors hereby declare no conflicts of interest to disclose.

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