Egyptian Journal of Orthopaedic Research "EJOR"
An international peer-reviewed journal published bi-annually

Volume 5, Issue 1, March. - 2025: pp: 19-25 www.ejor.sohag-univ.edu.eg

Doi: 10.21608/ejor.2024.418180

Original Article

TREATMENT OF UNSTABLE TROCHANTERIC FRACTURE: A COMPARATIVE STUDY BETWEEN DHS AND DHS WITH TROCHANTERIC STABILIZATION PLATE

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Received 15/8/2024 Accepted 22/2/2025

Abstract

Introduction: *The dynamic hip screw (DHS) is the standard implant for treatment of trochanteric fractures. Trochanter Stabilizing Plate (TSP) is a modular extension of the DHS that is employed to stabilize the greater trochanter and the lateral wall. This Prospective study was conducted to compare the results of using of DHS alone versus DHS with stabilizing plate for treating unstable trochanteric fracture (AO classification type A2).* ***Methods***: *167 patients were evaluated for eligibility; the criteria were not met by 12 patients, and 5 patients declined to participate in the study. The remaining patients were randomly allocated into two equal groups (75 patients in each) group 1 using DHS alone and group 2 using DHS with TSP. Clinical evaluation was done using Clinical Harris Hip Scoring System (Modified HHS). Radiological evaluation was done by x-ray to assess; healing time, neck shaft angle measurement and shaft medialization.* ***Results***: *Tip Apex Distance (TAD), the position of lag screw, and bone quality revealed insignificant differences between both groups. Postoperative healing was insignificantly different between both groups. Postoperative Harris hip score and neck shaft angle were significantly higher in group 2 than in group 1 (P value< 0.001 and 0.007 respectively).* ***Conclusion***: *DHS combined with stabilizing plates have better radiological and functional outcomes for treating unstable trochanteric fractures (AO classification type A2).*

Keywords: *Unstable Trochanteric Fracture, DHS, Trochanteric Stabilization Plate.*

1. Introduction

Intertrochanteric fractures of the hip are common in the elderly. While the incidence of these fractures has decreased in the western world, the absolute increase in the elderly population has led to doubling the number of these fractures over the past three decades and this trend is expected to continue [1]. Worldwide, it has been estimated that the total number of hip fractures could reach as high as 2.6 million by 2025 and 4.5 million by 2050 [2]. Compared to intracapsular fractures, Intertrochanteric fractures tend to occur in more people aged. Due to the increased life expectancy of the elderly and the proportional loss of bone density, these fractures tend to be more comminuted with aging; therefore, they are becoming more challenging for the surgeon [3]. In general, the two primary options for the treatment of such fractures are intramedullary fixation and extramedullary fixation. The dynamic hip screw (DHS) has become a standard implant in the treatment of these fractures, and it is frequently employed in extramedullary fixation. Trochanter Stabilizing Plate (TSP) is a modular extension of the Dynamic Hip Screw (DHS) that is employed to stabilize the greater trochanter and the lateral wall. There is a reduced incidence of femoral medialization and an improvement in the functional outcome when unstable intertrochanteric fractures are fixed with a TSP [4]. Dynamic hip screw systems have been the standard means of fixation of peri-trochanteric fractures in the last few decades and using of Trochanter Stabilizing Plate (TSP) they have been associated with decreasing failure rates in unstable fractures that may reach [4]. Main problems of unstable trochanteric fracture are shaft medialization and improper neck shaft angle mostly varus angulation which hinder normal gait and malunion occurs and such problems are not prevented by using DHS alone so anti-medialization plate (TSP) are used. The aim of this work was to compare the results of using a Dynamic hip screw (DHS) versus a dynamic hip screw (DHS) with stabilizing plate for treating unstable trochanteric fractures (AO classification type A2).

2. Patients and Methods

This Prospective study was conducted at the Orthopedic and Traumatology dept., Sohag University Hospital during the period between 2021:2023. The study was approved by our ethical committee and an informed consent was obtained from all participants. In this study, 167 patients were evaluated for eligibility, the criteria were not met by 12 patients, 5 patients declined to participate in the study. Inclusion criteria were; patients suffering from unstable trochanteric fracture with medial femoral cortex comminution and lesser trochanter displacement, Age: above 40 years, and AO type: A2. Patients were randomly allocated into two equal groups (75 patients in each). *Group 1:* patients treated with DHS. *Group 2:* patients treated with DHS and stabilizing plate.

2.1. *Exclusion criteria*

include stable trochanteric fractures, subtrochanteric extension, reverse oblique trochanteric fractures, and polytrauma patients.

2.2. *Preoperative management protocol*

On admission, Preoperative preparations and radiological evaluation using x-ray anteroposterior and lateral views. Anesthesia consultation to determine patient fitness for surgery.

2.3. *Operative technique*

Under spinal anesthesia, patient in supine position, preoperative IV broad-spectrum antibiotic was given. Closed reduction under fluoroscopy was done by flexion of hip abduction and external rotation then extension, adduction of hip in neutral position. lateral approach of the femur will be done incision from greater trochanter to about 6 cm below lesser trochanter. Insertion of guide wire using DHS guide angle under fluoroscopy. Triple reamer was used after detection of lag screw length. Lag screw was inserted over the guide wire. Then DHS plate fixed to the bone by cortical screws at least 8 cortices, fig. (1).

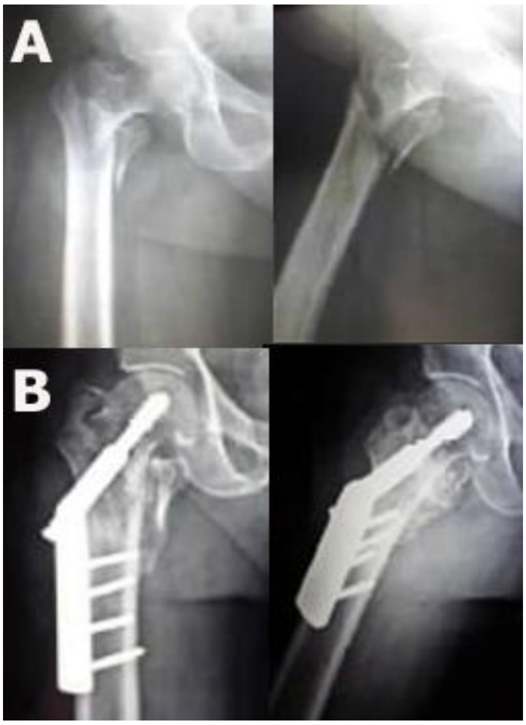

Figure (1) **a**. Preoperative x-ray anteroposterior and lateral views showing Trochanteric fracture with displaced lesser trochanter, **b**. Postoperative x-ray anteroposterior and lateral views after fixation of fracture with DHS alone.

When using TSP, plate was applied to inferior part of DHS plate to set in correct position superiorly over greater trochanter then cortical screws inserted to the holes of stabilizing plate. There is a hole in stabilizing plate for anti-rotation screw. Finally, we close of the wound in layers, fig. (2).

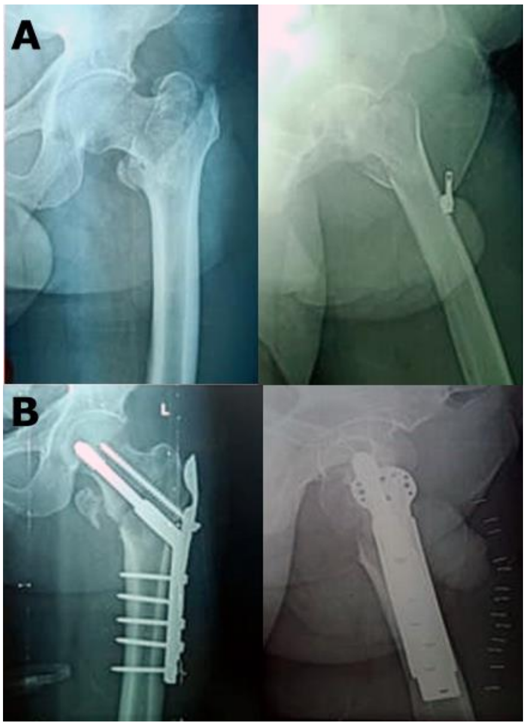

Figure (2) **a.** Preoperative x-ray anteroposterior and lateral views showing Trochanteric fracture with displaced lesser trochanter, **b.** Postoperative x-ray anteroposterior and lateral views after fixation of fracture with DHS combined with TSP.

2.4. *Postoperative management protocol*

After the first three days of intravenous broad-spectrum antibiotic therapy, all patients were transitioned to oral antibiotics (amoxicillin-clavulanic acid), Each patient was prescribed 40 IU of enoxaparin, a low molecular weight heparin, to avoid deep vein thrombosis (DVT) and PE after surgery, Following the surgery, patients were instructed to engage in vigorous hip and knee movements for the first two or three days. ***)** Clinical evaluation: Clinical Harris Hip Scoring System (Modified HHS). ***)** Radiological evaluation: healing time, neck shaft angle measurement, shaft medialization and assess the prober position of the implant. ***)** Time plan: after 2 weeks re-move stitches after ensuring clean healed skin, x-ray done at 6 weeks then every month up to 6 months then every 6 months up to 2 years. Clinical evaluation was done at 6 weeks then every 3 months up to 1 year then every 6 months up to 2 years.

2.5. *Statistical analysis*

The SPSS v26 statistical package was used to analyze the data (IBM Inc., Chicago, IL, USA). We employed an unpaired Student's t-test to compare the two groups on quantitative factors. Means and standard deviations (SD) provided the visual representation of the data. We calculated qualitative variables using Chi-square or Fisher's exact test, and we presented the results using percentages and frequencies. When conducting statistical analyses, a two-tailed P value of less than 0.05 was considered as significant.

3. Results

Age, sex, cause of fracture and follow-up period were insignificantly different between both groups. The type of fracture was trochanteric fracture in all patients in both groups, tab. (1). The time of admission was insignificantly different between both groups. Operative time was significantly higher in Group 2 than in Group 1 (P value= 0.002). Blood loss was significantly higher in group 2 than in group 1 (P value =0.009). Intraoperative complications didn’t occur in all patients in both groups, tab. (2). Tip Apex Distance (TAD), the position of the lag screw, and bone quality were insignificant differences between both groups. Medialization of the shaft of femur was significantly lower in group 2 than group 1 (P value= 0.006), tab. (3). Healing time was insignificantly different between both groups. Postoperative Harris hip score and neck shaft angle were significantly higher in group 2 than in group 1at last follow up. (P value< 0.001 and 0.007 respectively), tab. (4).

Table (1) Demographic data of both groups.

		Group 1 (n=75)	Group 2 (n=75)	P value
Age (years)	***Mean ± SD***	68.4 ± 8.85	65.2 ± 11.95	0.287
	Range	45 – 78	45 – 85	
Sex	***Male***	48(56%)	33(44%)	0.571
	Female	27 (48%)	42(52%)	
Cause of fracture	***Fall from height***	42 (56%)	39 (52%)	0.777
	Domestic fall	33 (44%)	36 (48%)	
Follow-up period (years)	***Mean ± SD***	1.89 ± 0.18	1.91 ± 0.08	0.492
	Range	1.6 - 2.2	1.8 - 2	

Table (2) Preoperative and intraoperative data of both groups.

		Group 1 (n=75)	Group 2 (n=75)	P value
Time of admission (days)	***Mean ± SD***	6.08 ± 2.56	6.08 ± 2.38	1.000
	Range	2 – 10	2 – 10	
Operative time (min)	***Mean ± SD***	61.44 ± 19.47	86.04 ± 31.6	**0.002***
	Range	40 – 120	40 - 120	
Blood loss (cc)	***Mean ± SD***	106.2 ± 12.19	118 ± 17.74	**0.009***
	Range	85 – 120	90 – 150	
Intraoperative complications	***None***	75 (100%)	75 (100%)	---
Complications	***Reoperation rate***	0	0	---
Lateral wall thickness (mm)		>25	>25	---

***:** *significant as P value ≤ 0.05*

Table (3) Radiological reults of both groups.

		Group1 (n=75)	Group 2 (n=75)	P value
TAD (mm)	***Mean ± SD***	24.04 ± 2.15	23.96 ± 1.77	0.886
	Range	20 - 27	20 – 27	
Position of lag screw	***Inferior in anteroposterior and central in lateral***	36(48%)	27(36%)	0.390
	Central/Central	39 (52%)	48 (64%)	
Bone quality	***Osteoporotic***	42 (56%)	45 (60%)	0.774
	Fair	33 (44%)	30 (40%)	
Medialisation of the shaft of femur		20 (26.67%)	7 (9.33%)	**0.006***

TAD: *Tip Apex Distance*

Table (4) Clinical results of both groups.

		Group1 (n=75)	Group 2 (n=75)	P value
Postoperative healing (weeks)	***Mean ± SD***	16.8 ± 2.31	15.92 ± 2.9	**0.241**
	Range	12 – 20	12 – 20	
Postoperative Harris hip score	***Mean ± SD***	86.08 ± 3.28	91.08 ± 3.59	**<0.001***
	Range	80 – 92	85 – 95	
Neck shaft angle (degree)	***Mean ± SD***	131.8 ± 2.1	133.32 ± 1.72	**0.007***
	Range	129 – 135	130 – 135	

4. Discussion

Intertrochanteric fractures often occur. The general population's life expectancy has grown over the last several decades, proximal femoral fractures are on rise, according to a number of epidemiological research. A complication rate of 20-30% and a mortality risk of 17-20% are associated with intertrochanteric hip fractures, which account for over 90% of all hip fractures in the elderly [5,6]. As a consequence of osteoporotic bones, most intertrochanteric femoral fractures in older individuals are mild to moderate in severity. Surgical treatment is the gold standard for most trochanteric fracture problems [7]. In the past, surgeons might use cephalomedullary nails, angular blade plates, or dynamic hip screws to stabilize intertrochanteric femoral fractures [8]. In this study, differences between the groups on measures of age, sex, and fracture origin were not statistically significant. Since all patients in both groups had trochanteric fractures. According to research by Rathod and Tijoriwala [9], which looked at 20 instances of new trochanteric fractures and the surgical treatment of traumatic fractures with the Dynamic Hip screw. Our focus throughout the procedure was on TAD. Between the ages of 66 and 80, the prevalence of trochanteric fractures peaks, and they are common among the elderly, particularly males. Accidents involving minor falls account for the vast majority of injuries, and the left side takes a disproportionately large beating. The use of a dynamic hip screw with a 135° side plate and barrel allows for early mobility of geriatric patients, lower mor-bidity and mortality, and tight fixation even in osteoporotic bone. These benefits are the result of surgical intervention per-formed early on. Many surgeons still choose DHS implants, according to our study, since they are long-lasting and reliable. Our data indicates that there was no statistically significant difference between the two groups in terms of the time of admission. Patients at high risk of posterior lateral wall fracture (PLWF) may benefit from TSP, according to research by Hsu et al. [10], which also looked at this question. It included 152 patients with A2 fractures who had DHS treatment alone or a combination of DHS and TSP (DHS-TSP). In our research, none of the included patients underwent reoperation. When compared to DHS alone, In 171 patients with a lateral wall thickness of less than 2.24 cm, therapy with DHS-TSP significantly enhanced lag screw sliding distances, PLWF rate, and reoperation rate [10]. After controlling for other factors, the reoperation rate for patients given TSP was thirteen times lower than for those given DHS alone, according to the multivariate study [10]. Implementing TSP into A2 fractures with an essential thin lateral wall thickness of less than 2.24 cm significantly decreases lag screw sliding lengths, PLWF rate, and reoperation rate. One of the independent risk factors for functional mobility is anemia, which is linked to higher rates of morbidity and death in patients with trochanteric fractures. Here, group 2 shows much more blood loss compared to group 1. No patient in either group had intraoperative problems. One possible explanation for this is that. Crossing the gluteus medius is the first step in intramedullary fixation using gamma nail, which might harm the peri-trochanteric artery circuit. Second, because the greater trochanter must be drilled to install an intramedullary device (gamma nail), this process disrupts the neo angiogenesis that occurs in the bone marrow. Briefly said Cai et al. [11] state that intramedullary fixation is linked to greater concealed blood loss, which warrants more investigation. Similarly, Ronga et al. [12] investigated the frequency of transfusions in patients who had Gamma nail or DHS stabilization of trochanteric fractures. Using multivariate approaches, the variables contributing to blood loss were examined (type of fracture, anticoagulant or antiaggregant therapy, and duration to surgery). In A1 fracture groups, the DHS was shown to have a significantly reduced blood loss than the Gamma nail at the multivariate analysis level ($p < 0.05$). Perioperative blood loss dictates that DHS be utilized for A1 fractures and Gamma nails for unstable A2 fractures. [11]. Both groups' postoperative x-rays revealed no statistically significant differences in TAD, lag screw location, or bone quality in this investigation. This is a safe value according to the study by Khairy et al. [13], which sought to highlight the clinical value of the tip apex distance as a reliable predictor of the cut-out of the lag screw in the fixation of stable ITF. In group 1, the TAD measured 23.96 ± 1.77, and in group 2, the TAD measured 24.04 ± 2.15. The authors found that a TAD of less than 25 mm is considered safe, but a TAD of more than 25 mm increases the risk of implant penetration, non-union, cut-through, and other problems. For these reasons, TAD is an important and trustworthy component of DHS management. In both groups, there was no discernible change in the lag screw's location, whether it was inferior in the anteroposterior or central in the lateral or Central/Central orientation. Both the anteroposterior and lateral radiographs show how critical screw placement is for optimal bone stock in the femoral head. However, Screws placed inferiorly and posteriorly, as found by Firas Abd Alhadi. [14], were found to end up with a greater amount of cancellous bone than the intended subchondral bone, resulting in implant failure. Both groups exhibited no statistically significant difference in postoperative healing, according to the data collected from the research. The outcomes of the surgery, both functionally and radiographically, show that TSP fixation of unstable intertrochanteric fractures with DHS is effective. This is in line with the findings of Shetty et al. [15], who examined the radiographic union and hip function after DHS repair of unstable intertrochanteric fractures (TSP). In a prospective study, 32 patients with ages ranging from 30 to 70 underwent open reduction along with DHS and TSP fixation. An assessment of hip function was conducted using the Harris hip score. Two patients had very excellent outcomes, five had decent results, five had acceptable results, and three had extremely unfavorable findings out of fifteen patients whose Harris hip scores were matched to the RUSH scores (interval between 10 and 20 points). From a possible seventeen individuals, seven received excellent results, five good ones, four average ones, and one terrible one. While various management approaches were considered, this research did not compare their quality. It should be noted that group 2 had substantially higher Post-operative Harris hip score, and neck shaft angle compared to group 1 (P value< 0.001 and 0.007, respectively). If the neck shaft angle is not maintained, it might induce handicap, making it just as crucial as a union. The neck shaft angle after DHS fixation was evaluated in a prospective study by Dar et al. [16] for intertrochanteric fractures. Radiographs were taken with both hips turned internally by 15 degrees to examine the non-fractured side of the neck and the restored or changed angle on the operated side following DHS surgical fixation. All of the fractures were effectively fused, as shown by the reduced average NSA from 136±4 degrees on the normal side to 126±4 degrees on the operated side. It is crucial to keep the neck-shaft angle close to normal after DHS has repaired an inter-trochanteric fracture in order to prevent valgus and varus malunion. Results were similar when Selvakumar et al. [17] looked at all unstable trochanteric fractures with lateral comminutions and found that the modular TSP and DHS were the best ways to prevent limb shortening, excessive telescoping/varus malposition, and complications. The functional result after surgery was evaluated at 20 weeks using the Harris Hip Score. Most people had a Harris hip score of 33.2. A biomechanically sound reconstruction for unstable intertrochanteric fractures that have communicated with the lateral wall is the trochanteric stabilization plate with a sliding hip screw. So long as the abductor and lever arms are strong enough, the lateral wall may be rebuilt in this way (power arm). Individuals with comminution between the lateral walls of unstable intertrochanteric fractures may benefit from a trochanteric stabilizing plate in terms of radiological and functional results. One of the study's strengths is the relatively long follow-up period (2 years). The prospective design of this study was a source of reliability to our findings. However, our research had some limitations. The small number of cases and DHS versus DHS with stabilizing plate were not evaluated in comparison to other internal fixation systems.

Conclusion

DHS combined with stabilizing plates is more effective as regard radiological and functional outcome for treating unstable trochanteric fractures (AO classification type A2) compared to DHS alone.

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