

## Results of Dynamic Hip Screw with Trochanteric Stabilizing Plate in Treatment of Unstable Trochanteric Hip Fractures

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### ABSTRACT

**Background:** Trochanteric hip fractures are common among elderly patients. They are categorized as stable and unstable fractures depending on integrity of postero-medial cortex. Integrity of lateral wall is important to prevent excessive fracture collapse and poor outcome.

**Objective:** This study aimed to assess the results of using dynamic hip screw with trochanteric stabilizing plate (TSP) in management of unstable trochanteric fractures (A2 and A3 patterns in AO classification).

**Patients and methods:** Forty patients with unstable hip fractures were operated in Kasr Alainy Hospital using dynamic hip screw (DHS) with TSP. The study had a minimum follow up of 18 months.

**Results:** In this study, operative time ranged from 90 to 180 minutes with mean of  $105.5 \pm 24.06$ . Six patients (15%) had 500 cc packed RBCs transfusion and only one case (2.5%) needed 1000 cc of packed RBCs. At 6 weeks HSS ranged from 20 to 80 points, the mean was  $54.94 \pm 16.17$  points. At 3 months the HSS ranged from 43 to 89 points, the mean was  $70.22 \pm 12.65$  points. At 6 months the HSS ranged from 50 to 100 points, the mean was  $82.81 \pm 10.37$  points. At 12 months the HSS ranged from 55 to 100 points, the mean was  $89.09 \pm 9.20$  points. At 18 months the HSS ranged from 62 to 100 points, the mean was  $93.84 \pm 7.95$  points.

**Conclusion:** TSP is a good option in management of unstable trochanteric fractures. We recommend making more studies on TSP to reveal its efficacy.

**Keywords:** Dynamic, Hip, Screw, Trochanteric, Hip fractures.

### INTRODUCTION

Hip fractures are those which occur between the articular margins of the femoral head to 5 cm below the lesser trochanter. They are divided into extracapsular and intracapsular hip fractures. The extracapsular hip fractures are subdivided into pertrochanteric and subtrochanteric fractures <sup>(1)</sup>.

Hip fractures occur most commonly in elderly patients. Decreasing bone mass with age increases the risk of hip fractures. That is why hip fractures in elderly generally occur from low energy trauma. Intertrochanteric fracture femur represents approximately 50% of all proximal femur fractures.

Based on the integrity of the postero-medial cortex, the Evan's classification system divides the intertrochanteric fractures into stable and unstable fractures <sup>(2)</sup>.

The conservation of the side trochanteric wall was significant in reducing a planned fracture influence. Disruption of the lateral wall, after miniaturization and fixture progress to excrescent fracture breakdown and less results. Integrity of the lateral cortex considered the most common factor leading to post-operative failure and reoperation <sup>(3)</sup>. The operative management of intertrochanteric fractures can be done with different implant choices. Dynamic compression hip screw, proximal femoral nail, fixed angle blade plate and locked plate proximal femur are examples of implant choices in such fracture pattern <sup>(4)</sup>.

Trochanteric stabilizing plate over dynamic hip screw provides lateral buttress for the proximal fragment. This buttressing for the lateral cortex prevents

excessive fracture collapse, limb shortening and fixation failure <sup>(4)</sup>.

The purpose of this study is to assess the results of using dynamic hip screw with trochanteric stabilizing plate in management of unstable trochanteric fractures (A2 and A3 patterns in AO classification).

### PATIENTS AND METHODS

This prospective study was conducted in Kasr Alainy Hospital in the period from June 2018 to June 2020. It included patients with unstable type of trochanteric fractures AO/OTA classification 31-A2 and 31-A3.

#### Inclusion criteria:

1. Skeletally mature patients which have diagnosed unstable trochanteric fractures AO/OTA classification 31-A2 and 31-A3 types.
2. Both genders.
3. Age from 50 to 90.

**Exclusion criteria** were polytrauma patients, pathological fractures, open fractures, bed ridden patients, patients below 50 years or above 90 years, and patients with dementia.

#### Sample size calculation:

The size of the sample was obtained by IBM<sup>®</sup> SPSS<sup>®</sup> Sample Power<sup>®</sup> version 3.0.1 (IBM<sup>®</sup> Corp., Armonk, New York, United States). A previous study by **Patil and Srinivas** <sup>(5)</sup> reported that the Harris Hip Score at 6 months was 85.45 (SD 6.04). A minimal sample size of 40 cases will have 80% power to detect an expected difference of 3 in the Harris Hip Score at 6 months, at

5% significance level. Patients who fulfilled the inclusion criteria were managed using dynamic hip screw and trochanteric stabilizing plate.

**Ethical consent:**

This study was ethically approved by the Institutional Review Board of the Faculty of Medicine, Cairo University. Written informed consent was taken from all participants. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

**Statistical analysis**

All data was collected, tabulated, and statistically analysed using SPSS (ver. 22.0) for windows (SPSS Inc., Chicago, IL, USA). Qualitative data was expressed as absolute frequencies (number) and relative frequencies (percentage), and quantitative data was expressed as the mean and SD, and median (range). Descriptive statistics were used to describe demographic and key clinical characteristics of the study population.

**RESULTS**

There were 40 patients with unstable trochanteric fractures included in this study treated with trochanteric stabilizing plate and dynamic hip screw. All cases had a minimum of 18 months follow up except for 7 patients who died early during follow up.

**Intraoperative and perioperative events outcomes:** Operative time ranged from 90 minutes to 180 minutes. The mean was 105.5 minutes. Six cases had 500cc packed RBCs transfusion and only one case needed 1000cc packed RBCs transfusion post operatively (Table 1).

**Table (1): Operative time and blood transfusion.**

<b>Operative time (minutes)</b>	<b>Mean ± SD</b>	105.5 ± 24.06
	<b>Median (weeks)</b>	90 (90-180)
<b>Blood transfusion</b>	<b>500 cc</b>	6 cases 15%
	<b>1000 cc</b>	1 case 2.5%

**Radiological outcomes:** Radiographs in combination with clinical examination were used to assess bony union of the fracture. The time to full bony union ranged from 11 to 22 weeks with median of 16 weeks. It had a mean of 16.38 weeks ± 3.01 weeks Table 2.

**Table (2): Time of bony union.**

<b>Bone union (weeks)</b>	<b>Mean ± SD</b>	16.38 ± 3.01
	<b>Median</b>	16 (11 – 22)

**Functional outcomes**

**Partial weight bearing:** In this study, the start of partial weight bearing ranged from 2 to 10 weeks. It had a mean of 6.44 ± 1.66 weeks (Table 3).

**Table (3): Partial weight bearing.**

<b>Partial weight bearing (weeks)</b>	<b>Mean ± SD</b>	6.44 ± 1.66
	<b>Median (weeks)</b>	6 (2 – 10)

**Harris Hip Score (HHS):**

At 6 weeks follow up, there were 25 patients had poor outcome and only one patient had good outcome. At 3 months, there were 13 patients had poor outcome, and only one patient had excellent outcome. At 6 months, there were 12 patients had excellent outcome and one patient had poor outcome. At 12 months, there were 15 patients had excellent outcome and one patient had poor outcome. While, at 18 months, there were 23 patients (69.7%) had excellent outcome and one patient (3%) had poor outcome (Table 4).

**Table (4): HHS at 6 weeks, and at 3, 6, 12, and 18 months follow up**

HHS	6 weeks		3 months		6 months		12 months		18 months	
	N	%	N	%	N	%	N	%	N	%
Poor	25	75.8	13	39.4	1	3	1	3	1	3
Fair	7	21.2	11	33.3	10	30.3	3	9.1	0	0
Good	1	3	8	24.2	10	30.3	14	42.4	9	27.3
Excellent	0	0	1	3	12	36.4	15	45.5	23	69.7

Table 5 summarizes HHS at HHS at 6 weeks, and 3, 6, 12, and 18 months follow up. At 6 weeks HSS ranged from 20 to 80 points. At 3 months ranged from 43 to 89 points, at 6 months the HSS ranged from 50 to 100 points, at 12 months ranged from 55 to 100 points, while at 18 months the HSS ranged from 62 to 100 points.

**Table (5): HHS of the participants.**

<b>HHS at 6 weeks</b>	<b>Mean ± SD</b>	54.94 ± 16.17
	<b>Median (range)</b>	55 (20-80)
<b>HHS at 3 months</b>	<b>Mean ± SD</b>	70.22 ± 12.65
	<b>Median (range)</b>	72 (43 -89)
<b>HHS at 6 months</b>	<b>Mean ± SD</b>	82.81 ± 10.37
	<b>Median (range)</b>	82 (50-100)
<b>HHS at 12 months</b>	<b>Mean ± SD</b>	89.09 ± 9.20
	<b>Median (range)</b>	89 (55 -100)
<b>HHS at 18 months</b>	<b>Mean ± SD</b>	93.84 ± 7.95
	<b>Median (range)</b>	97 (62-100)

**Complications:**

In this study, total number of patients who had complications was 8 (20%) patients (Table 6).

Superficial infection occurred in 2 (5%) cases. They were treated using intravenous antibiotics for one week and daily dressing for the wound; until the wound became clean. One (2.5%) patient had foot drop post operatively. It developed later on superficial wound infection and DVT. Superficial infection was treated as before until wound became clean. After confirmed diagnosis of DVT, the patient was given a three month course of warfarin until became cured.

For foot drop, we prescribed neurotropic medications and physiotherapy for the patient for 3 weeks. There was no improvement, so we asked for nerve conduction velocity testing and EMG. The test showed evidence of peripheral neuropathic lesion of the sciatic nerve affecting mainly the common peroneal part with normal tibial component suggestive of partial proximal lesion at the hip level. After 6 months there was no clinical improvement, and the test showed no recovery or improvement. Therefor the patient was referred for tendon transfer. Intraoperatively, this patient needed open reduction of the fracture, the cause of the lesion could be faulty placement of the Hohmann retractors or the reduction clamps during the manipulations for achieving open reduction.

Two (5%) patients had implanted related complications in the form of lag screw cut through. One of the patients was 85 years old; she had delayed weight bearing and developed bed sores and died early during follow up. The other patient was scheduled for removal of the implant and arthroplasty. There were 3 (7.5%) patients who had deep infection. Debridement was done for the three patients. According to culture and sensitivity, intravenous antibiotics were prescribed for the patients for six weeks postoperatively. Two of the three cases were cured with no recurrence of infection.

The other patient was taking corticosteroids and immunosuppressants for treatment of rheumatoid arthritis. The infection was recurrent and patient refused debridement operation. According to culture and sensitivity we prescribed antibiotics for 6 weeks until the patient was improved and the wound became clean. Then the patient had a several courses of recurrence and improvement of infection. After one year the implant was removed with no recurrence of infection.

**Table (6): Complication types and rates of the studied patients**

Complications	Number of cases	Percent
Superficial infection	3	7.5%
Deep infection	3	7.5%
Cut through	2	5%
DVT	1	2.5%
Foot drop	1	2.5%
Bed sores	1	2.5%

**DISCUSSION**

Per trochanteric fractures are very common injuries that affect mainly elderly more than young people. Dynamic hip screw and other ordinary implants can manage stable fracture patterns. On the other hand, Unstable trochanteric fractures are very difficult to manage with a greater incidence of implant failure and complications<sup>(6,7)</sup>.

The most common complications are lateral wall fracture, varus collapse and medialisation of the femoral shaft<sup>(8)</sup>.

There are other prospective studies done in the past few years evaluating the results of using DHS with TSP in management of unstable trochanteric fractures. **El Banna et al.**<sup>(9)</sup> studied 20 cases for 12 months. **Agrawal et al.**<sup>(10)</sup> study group was 25 patients with trochanteric fractures who were treated using DHS and TSP and followed up for a minimum of 6 months. **Selim et al.**<sup>(11)</sup> had 20 cases of TSP compared with 20 cases of proximal femoral locked plate (PFLP) for 6 months.

**Haddon et al.**<sup>(12)</sup> compared DHS and TSP with DHS alone for 12 months. **Patidar et al.**<sup>(13)</sup> compared between prospective 40 cases of TSP with retrospective 41 cases of DHS alone for 6 months follow up. **Shetty et al.**<sup>(14)</sup> had 32 patients with TSP followed up for 6 months.

**Fu et al.**<sup>(15)</sup> compared 171 cases of TSP with 70 cases of PFN which is quiet larger sample size, but it was a retrospective study and had short term follow up of 10 months.

**Fu et al.**<sup>(15)</sup>, found that the operation time was significantly shorter in the DHS+TSP group than that in the PFNA group (84.0 vs. 96.4 min), this was significantly shorter than in our study.

**Patil and Srinivas**<sup>(5)</sup> compared 22 patients of proximal femoral nail (PFN) versus 22 patients of DHS with TSP. The TSP group had a mean operative time of 104.54. **Kim et al.**<sup>(16)</sup> compared retrospectively 43 patients with unstable intertrochanteric fractures who were separated into two groups (21 patients with PFN) and (22 patients with DHS and TSP). The TSP group had mean operative time of 109 minutes. In both studies the mean operative time was not significantly different than in our study.

**Fu et al.**<sup>(15)</sup> found less postoperative decrease in hemoglobin in the DHS+TSP group than in PFN group. **Patil and Srinivas**<sup>(5)</sup> had meant intraoperative blood loss was 131 ml in the TSP group.

**Selim et al.**<sup>(11)</sup> who compared 20 patients treated with DHS and TSP versus 20 patients treated with PFLP, reported Time to bony union in the TSP group had an average of 14.47 (SD 5.37) weeks. **Patil and Srinivas**<sup>(5)</sup> reported average time of bony union in the TSP group was 14 weeks. **Kim et al.**<sup>(16)</sup> found that mean time to union was 15.23 weeks. The time to bony union in these studies was shorter than our study.

**Kim et al.**<sup>(17)</sup> retrospectively compared 151 patients with unstable trochanteric fractures who were

managed by PFNA (53 cases, group I), gamma nail (31 cases, group), DHS with TSP (43 cases, group III), and helical blade type LCP-DHS with TSP (24 cases, group IV). The mean time to union in the TSP group was 18.21 (SD 1.2) weeks. **Cho et al.**<sup>(18)</sup> retrospectively studied 27 cases of unstable trochanteric fractures that were managed using TSP. They achieved bony union in an average of 18.7 weeks (range, 16 to 25 weeks). The time to bony union in these studies was longer than our study. **Raman et al.**<sup>(19)</sup> conducted their study over 49 patients with trochanteric fractures who were managed using TSP. they found that the time taken for radiological consolidation of fracture was 15.8 weeks. **Kim et al.**<sup>(20)</sup> reported that the mean time to bony union was 16.2 weeks. These studies had no significant difference than our study in the time to bony union.

**Shetty et al.**<sup>(14)</sup> used HHS for functional evaluation of patients; they reported 9 of the 32 (28.125 %) patients had excellent results as per the Harris hip score, 10 (31.25%) patients had good results, 9 (28.125%) patients had fair outcome and 4 (12.5%) patients had poor results at 6 months follow up.

In **Raman et al.**<sup>(19)</sup> study, 42 (86%) patients had an excellent HHS of >90 points and 7 (14%) patients had a good HHS of >80 points that was significantly higher than our scores. They used different type of plates, modified ordinary T buttress plate as TSP.

**Patidar et al.**<sup>(13)</sup> study was conducted over 81 patients, which was separated into two groups. Group A with 40 patients operated using DHS with TSP, and group B with 41 patients operated using DHS alone. The functional outcome was measured using the HHS. Average functional score was 76 in TSP group and 61.68 in DHS group.

**Agrawal et al.**<sup>(10)</sup> reported that at one year follow up, all patients were walking without support and 50% had good Harris Hip Score and 50% had excellent Harris Hip Score. It is higher score compared to our study at one year follow up; we had 45.5% excellent and 42.4% good and 9.1% fair and 3% poor score.

**El-Banna et al.**<sup>(9)</sup> reported post-operative complications in 4 (20%) cases. Those complications were in the form of (superficial wound infection in two cases, implant failure in one case after 1.5 months, screw extrusion in one case at 3 months and secondary varus in one case at three months as a sequela of excessive fracture collapse). This was the same as our complication rate but they differ in the types.

**Patil**<sup>(21)</sup> reported only 9% complication rate with TSP group. One case of superficial infection and one case of revision operation. This was significantly lower than our study.

**Shetty et al.**<sup>(14)</sup> reported that they had not noted in their series some complications such as infection, scar dehiscence, implant failure, re-fracture, mal-union, non-union, requirement of re-surgery, etc.

Several studies supported the use of DHS with TSP in management of unstable trochanteric fractures. **El-Banna et al.**<sup>(9)</sup> concluded that DHS with TSP is good

treatment for unstable fractures. **Agrawal et al.**<sup>(10)</sup> recommend the utilization of TSP with DHS in unstable fracture type as it has excellent functional outcomes.

**Patil**<sup>(21)</sup> stated that PFN is technically more demanding surgery, as compared to DHS with TSP, and they found complication rate of PFN to be higher as compared to DHS with TSP. **Selim et al.**<sup>(22)</sup> reported that TSP with DHS has superior results over PFLP in treatment of unstable trochanteric fractures.

**Fu et al.**<sup>(15)</sup> said that DHS and TSP provided ideal surgical outcomes, which were not inferior to the PFNA in treatment for unstable intertrochanteric fracture. **Kumar et al.**<sup>(23)</sup> found no functional or radiological difference between TSP and PFN groups.

Although many recent studies recommended the use of TSP in unstable trochanteric fractures, **Selim et al.**<sup>(22)</sup> in their meta-analysis of five studies found no significant difference in functional outcome between cephalo-medullary nails group and DHS with TSP group but increased revision rates in TSP group.

**Haddon et al.**<sup>(12)</sup> reported some Complications, which included two deep infections, one DVT, one stroke, one pulmonary embolism and one ileus all within 6 weeks, and one amputation at four months. And they noted that TSP has minimal effect on unstable three-or-more-part trochanteric fractures. They conclude that the routine use of Trochanteric Support Plates on unstable multi-fragment trochanteric fractures is questionable.

## CONCLUSION

This study assessed the outcome and complications of using DHS with TSP in management of unstable trochanteric fractures in elderly populations. This study results were comparable to other studies that used the same method or other methods like PFN in such fracture types. We found using TSP in these types of fractures had better results than PFLP in other studies.

We found that DHS with TSP is a reliable method for fixation of unstable trochanteric fractures with good outcomes and little complication rates. We recommend more studies to be with larger sample of patients and longer follow up period. Also, we recommend other studies to be comparable with other fixation methods in order to assess the best treatment method for such fracture patterns.

**Conflict of Interest:** None

**Fund:** Self

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