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Locked Dynamic Hip Screw Plate for Elderly Patients with Trochanteric Femur Fracture

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ABSTRACT

Background: Proximal Femoral fractures are common in elderly. Their incidence had increased due to the increased life expectancy and osteoporosis.

Objective: The aim of this study was to evaluate the use of locked dynamic hip screw plate (LDHS) as a treatment of intertrochanteric femoral fracture in elderly patients.

Patients and Methods: This study was a non-randomized clinical trial including eighteen patients with intertrochanteric femoral fracture fixed with locked dynamic hip screw plate. They came to Orthopedic Department in Zagazig University Hospital and Orthopedic Department in Tripoli Central Hospital over 3 months from July 2020 until September 2020. Patients with sub-trochanteric extension were excluded. There was 10 cases group A1 and eight cases group A2 according to AO Orthopedic Trauma Association (OTA).

Results: Clinical and radiological outcome assessments showed that 77.8% were excellent clinically, 11.1% were good and 11.1% were fair. Regard radiological assessment, 83.3% were excellent, 11.1% were good and 5.6% were fair. As regards complications, 4 cases had groin pain and 1 case had lag screw cut-out and overall complications were in 22.2%.

Conclusion: Locking DHS plate for trochanteric femur fractures is a good option in elderly patients.

Keywords: Locked Dynamic hip screw (DHS), Elderly patients, Femur fracture..

INTRODUCTION

Hip fractures are a leading cause of disability among the elderly. Treatment goals for this patient population include early mobilization with restoration of the anatomic alignment of the proximal part of the femur and maintenance of the fracture reduction [(1)]. Trochanteric femur fractures account for nearly 50% of all fractures of proximal femur from which 50 – 60 % are classified as unstable. Unstable fracture patterns occur more commonly with increased age and low bone mineral density. Patients who suffer intertrochanteric fractures tend to be more limited ambulators and more dependent in their care [(2)].

The care of the patients with trochanteric femur fractures has advanced dramatically since the advent of internal fixation. However, the differences in failure rates between stable and unstable intertrochanteric hip fracture patterns have recently been emphasized [(3)]. Restoring mobility in patients with unstable intertrochanteric fracture ultimately depends on the strength of the surgical construct. Dynamic hip screw (DHS) is commonly used for treating stable intertrochanteric fractures. DHS complications include shortening, medicalization of the distal fragment, implant cut-outs, uncontrolled lateralization of the proximal fragment, and varus collapse [(4)].

The most common mode of failure is for the lag screw to cut out of the femoral head, the second is for the plate to be forced off the femur with the screws being pulled out of the osteoporotic bone. The post-operative cut out ranges from 1% to 6% [(5)]. To overcome these problems a locking plate and screw system has been developed. The locking compression plate is the combination of two completely different anchorage technologies in one implant [(6)]. Locked side plate for DHS is better than standard DHS plate in treating intertrochanteric fractures in terms of lowering of complications rate and maintenance of reduction [(7)]. The aim of this study was to assess the use of (LDHS) as an efficient treatment of inter trochanteric femoral fracture in elderly patients.

PATIENTS AND METHODS

This study was a non-randomized clinical trial including eighteen patients aged above 50 years old with intertrochanteric femoral fracture fixed with locked dynamic hip screw plate; 12 patients came to Orthopedic Department, Zagazig university hospital and 6 patients came to Orthopedic Department, Tripoli Central Hospital over 3 months from July 2020 until September 2020 and followed up for 6 months. Patients with sub-trochanteric extension, unstable pattern of fracture and patients with severe debilitating disease were excluded.

Ethical approval: Institutional Review Board (IRB) approval was taken from Zagazig University and also informed written consent was taken from patients and/or their caregivers. **This Work was performed according to the code of Ethics of the World**

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Medical Association (Declaration of Helsinki) for studies involving humans.

Pre-operative:

All patients underwent full history taking, detailed orthopedic examination and clinical and radiological evaluation. After primary stabilization of the patient, plain X-ray films with an anteroposterior view of pelvis including both hip joints in 15° internal rotation and a lateral view of hip joint were obtained. Each fracture was classified using AO Orthopedic Trauma Association (OTA). In this study, there were 10 hips with intertrochanteric fracture grade A1 and eight hips grade A2. Skin traction was done as to plint the fracture until the definitive management was planned. Broad spectrum antibiotic in the form of intravenous cephalosporin was administered during induction of anesthesia.

Surgical technique:

After spinal or general anesthesia according to the anesthesia specialist, the patient was positioned to a fracture table with both legs on extension rails. The fracture was reduced by traction in abduction and then internal rotation of the lower limb. In five cases closed reduction failed then open reduction was performed through the lateral approach. Varus malalignment was found in three cases that were corrected by additional longitudinal traction to disengage the fracture fragments, followed by reduction. Posterior sag was found in five cases as a result of posterior comminution and corrected by manual correction with upward pressure applied to the buttock. Once the fracture was reduced, the patient was draped.

Figure (1): Straight lateral skin incision.

Straight lateral skin incision, beginning two fingers breadth below the tip of the greater trochanter (figure 1) was done. The iliotibial tract was split longitudinally from the tip of the trochanter distally. The vastus lateralis muscle was elevated anteriorly followed by elevation of the periosteum. Hohmann's retractors were inserted anteriorly in the region of the proximal femur.

The locked DHS angled guide was attached. Locked DHS guide wire with threaded tip was inserted into the sub-chondral bone. The guide wire was inserted to be central in the neck and the head in both anteroposterior and lateral views. The guide wire remained in place throughout the entire internal fixation. The position of the guide wire was checked with the image intensifier in both the anteroposterior and lateral planes. The locked DHS measuring device was pushed over the guide wire. The length that was red of the guide wire was inserted in the bone directly. Then 10 mm from the length measured with the locked DHS measuring device was subtracted, and the setting of the triple reamer was adjusted (Reaming with locked DHS triple reamer) and the locked DHS triple reamer was attached.

Figure (2): Measuring the length.

The hole produced in one operation had three different diameters: one for the screw, one for the plate cylinder and one for the junction of plate and cylinder. The depth of drilling could be adjusted in 5 mm steps. The three elements of the locked DHS triple reamer were so designed that incorrect assembly was not possible.

The locked DHS triple reamer was removed. The locked DHS centering sleeve was attached to the locked DHS tap and mounts the handle on the tap. The lag screw was screwed into the femoral head together with the long centering sleeve over locked DHS. When the zero marking in the window was reached, the upper semicircular edge of the centering sleeve that points towards the femur, the end of the screw had reached the lateral cortex. The handle of the screw wrench at the end must be parallel to the femoral shaft. Otherwise the locked DHS plate couldn't be pushed over the screw. The locked DHS plate was pushed onto the femoral shaft until it touched the lateral cortex. The guide wire was removed. The plate was driven with the impact or. The locked DHS plate was inserted, locked and screwed to the femoral shaft (figure 3).

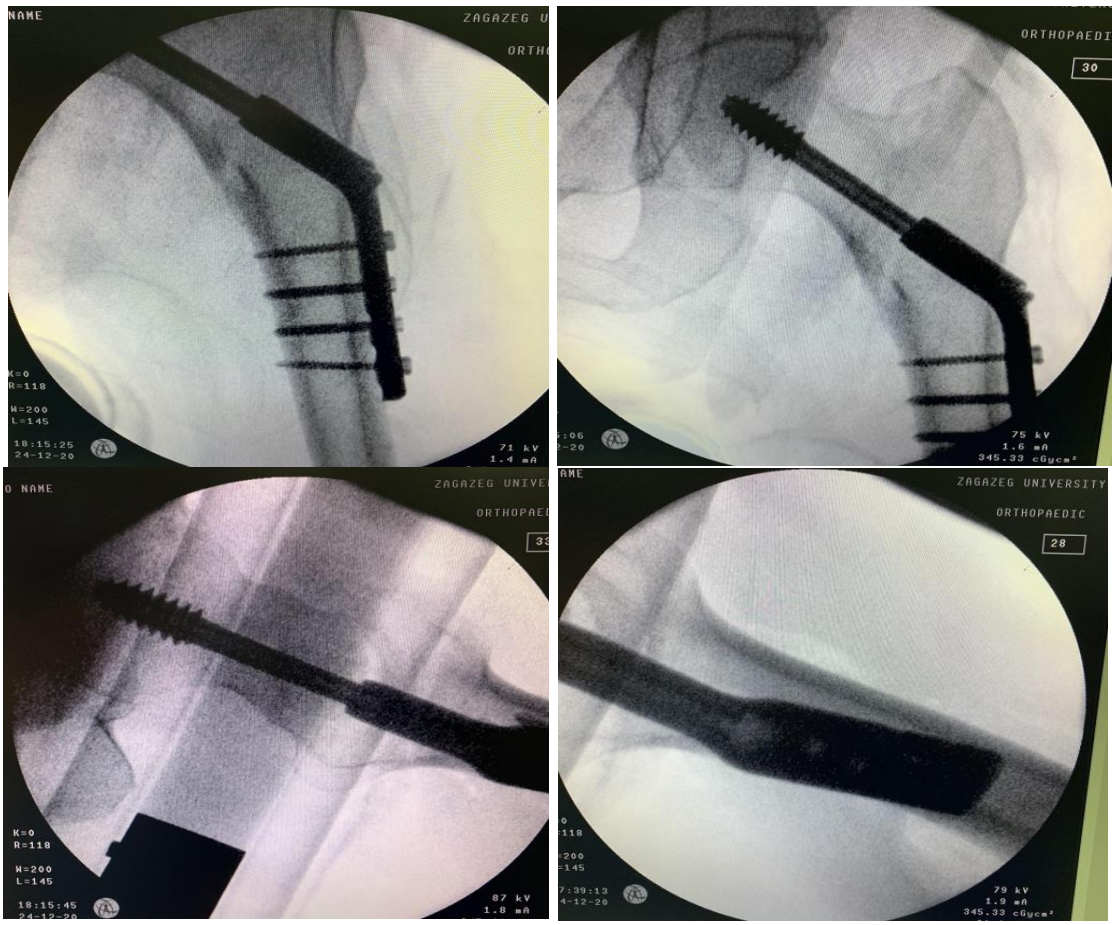

Figure (3): Attaching the locked DHS plate.

Compression of the fragments was done with locked DHS compression screw. After a radiographic check of the result, suction drain was inserted beneath the muscle. The wound was irrigated and then closed in layers.

Post-operative follow-up:

Immediate post-operative X-rays to ensure good reduction and good position of the implant, intravenous broad spectrum antibiotic was administered for three days and low molecular weight heparin was started twelve hours after surgery. All patients started range of hip and knee motion as well as quadriceps strengthening exercises in the second postoperative day. Partial weight bearing is allowed according to stability of reduction. Full weight bearing was not allowed till good amount of fracture healing. Patients were followed up at 2 weeks for removal of sutures, 6 weeks, 12 weeks and 6 months for follow up check X rays. Anteroposterior and lateral radiographs were examined for union, lag screw position, collapse of fracture, Tip-apex distance (TAD) and femoral shortening. Potential complications were looked.

Statistical analysis

The collected data were coded, processed and analyzed using the SPSS (Statistical Package for Social Sciences) version 22 for Windows® (IBM SPSS Inc, Chicago, IL, USA). Data were tested for normal distribution using the Shapiro Walk test. Qualitative data were represented as frequencies and relative percentages. Chi square test ($\chi 2$) to calculate difference between two or more groups of qualitative variables. Quantitative data were expressed as mean ± SD (Standard deviation). Independent samples t-test was used to compare between two independent groups of normally distributed variables (parametric data). P value < 0.05 was considered significant.

RESULTS

The mean age at time of surgery was 72.77 ± 11.0 with minimum 53 and maximum 93 years, and BMI was distributed as 26.17 ± 2.17 with minimum 23.2 and maximum 30.2. As regards the sex distribution, the females represent 55.6% of studied group while the males represent 44.4% (Table 1).

Mean time before surgery was 3.88 ± 2.24 days with a minimum of one day and a maximum of 10 days, eleven cases were left sided (61.1%) and seven cases were right sided (38.9%). The most common mechanism of injury (MOI) was simple fall (55.6%) then RTA and fall down stairs were 22.2% and regards the AO classification A1 was 55.6% and A2 44.4% (Table 2).The mean operative time was 115.27 ± 30.98 minutes with a minimum of 85 and a maximum of 180 minutes. The union time was distributed as 13.72 ± 1.01 with a minimum of 12 and maximum 15 weeks (Table 3). Fourteen hips (77.8%) were excellent clinically, two

hips (11.1%) were good and two hips (11.1%) were fair. Regarding radiological, 83.3% were excellent, 11.1% were good and 5.6% were fair (Table 4).

Two cases had mild groin pain, 2 cases had severe groin pain and 1 case had lag screw cut-out, overall complication affected 22.2% (Table 5).

Table (1): Demographic data distribution among studied group: (N=18)

Age	**Mean ± SD**	**72.77 ± 11.0**	
	Median (Range)	**73.0 (53-93)**	
BMI	**Mean ± SD**	**26.17 ± 2.17**	
	Median (Range)	**25.90 (23.2-30.2)**	
		N	**%**
Sex	**Female**	**10**	**55.6**
	Male	**8**	**44.4**
	Total	**18**	**100.0**

Table (2): Fracture characters distribution among studied group

		Time before surgery in days	
Mean ± SD		**3.88 ± 2.24**	
Median (Range)		**3.0 (1-10)**	
		N	**%**
Side	**Lt.**	**11**	**61.1**
	Rt.	**7**	**38.9**
MOI	**Fall down stairs**	**4**	**22.2**
	RTA	**4**	**22.2**
	Simple fall down	**10**	**55.6**
AO Classification	**A1**	**10**	**55.6**
	A2	**8**	**44.4**
	Total	**18**	**100.0**

Table (3): Operation duration and Union time distribution among studied group

	Operation time/ Minutes
Mean ± SD	**115.27 ± 30.98**
Median (Range)	**105.0 (85-180)**
	Time of _union/ Weeks
Mean ± SD	**13.72 ± 1.01**
Median (Range)	**14.0 (12-15)**

Table (4): Clinical and radiological outcome assessment

		N	**%**
Clinical outcome assessment according to Harris hip score	**Excellent**	**14**	**77.8**
	Good	**2**	**11.1**
	Fair	**2**	**11.1**
Radiological outcome assessment according to Foster's rating system	**Excellent**	**15**	**83.3**
	Good	**2**	**11.1**
	Fair	**1**	**5.6**
	Total	**18**	**100.0**

Table (5): Complication distribution among studied group

		N	**%**
Groin pain	**No**	**14**	**77.8**
	Yes	**4**	**22.2**
Infection	**No**	**18**	**100.0**
	Yes	**0**	**0.0**
Mal- union	**No**	**18**	**100.0**
	Yes	**0**	**0.0**
Delayed union	**No**	**18**	**100.0**
	Yes	**0**	**0.0**
Lag screw cut-out	**No**	**17**	**94.4**
	Yes	**1**	**5.6**
Overall complication	**Not complicated**	**14**	**77.8**
	Complicated	**4**	**22.2**
	Total	**18**	**100.0**

DISCUSSION

Age in this study was distributed as 72.77 ± 11.0 with a minimum of 53 and a maximum of 93 years, which is greater than the mean age reported by **Barwar *et al.*** [5] who reported mean age of 64.8 and **Yadkika *et al.*** [8] who reported mean age of 67 years. Age has negative correlation with the final outcome in this study.

In this study, females represented 55.6% of studied group while males represented 44.4%. There was a female sex preponderance seen in our study. This is the same as in **Dhar *et al.*** [9] and **Zhang *et al.*** [10] studies, while **Yadkika *et al.*** [8], **Daivesh *et al.*** [11] and **Chang *et al.*** [12], showed male sex preponderance. In this study, there was no significant correlation between sex and the final outcome.

Mean time before surgery was 3.88 with a minimum of 1 day and a maximum of 10 days. The shorter the time from admission to surgery the better is the result. This conforms with **Barwar *et al.*** [5] and **Dhar *et al.*** [9].

Guo-Chun *et al.* [13] studied the treatment of trochanteric fractures with a proximal femur locking compression plate and found that average operative time was 35.5 minutes. **Govindasamy *et al.*** [14], who studied dynamic hip screw with locking side plate in the fixation of trochanteric fractures retrospectively, reported that the average operative time was 50 minutes. Operation duration in our study was distributed as 115.27 ± 30.98 with minimum 85 and maximum 180 minutes. **Zhong et al.** [15] compared the fixation of femoral fractures with PFLP versus DHS in 83 patients. In their 30 cases who were grouped as unstable inter-trochanteric fractures. They reported that the mean operative time was 55.7±3 minutes for PFLP versus 60 ± 3.3 minutes for DHS.

Asif *et al.* [16] reported that the mean operative time for cases of unstable intertrochanteric fractures treated by dynamic hip screw with locking side plate was 75 ± 5 minutes compared to 56 ± 9 minutes for cases treated by DHS. It was noted that, more satisfactory results were associated with patients who had less operative time compared to those with more operative time. However, there was no statistically significant

correlation between the operative time and the final score.

Another author studied the outcome of Locking Dynamic Hip Screw fixation was **Nikhil *et al.*** [17]. They enrolled 25 patients admitted in their health facility in India with inter-trochanteric femur fractures. All of their patients were considered to be elderly and clinical and radiological outcomes were evaluated with regular follow-up and the functional grading was done according to Harris Hip Score.

As regards the duration of union, they defined successful fracture union as complete bridging callus in 3 cortices together with painless full weight bearing and according to that definition, they found that of 25 patients, 10 patients (40%) exhibited radiological union before 12 weeks, 12 patients (48%) exhibited union between13-16 weeks and 3 patients (12%) showed union between 17-24weeks.

The average radiological union time was 13.96 weeks. This was significantly longer than our mean duration of union. The average Modified Harris Hip Score in their study was 82.12 with the range of 66.5-92.5. The complications came across were not very severe in nature.

12% of the patients had superficial wound infections, which responded to antibiotics alone, 4% of them had deep infection for which prolonged course of IV antibiotics and protected weight bearing was observed and 8% of them had decubitus ulcers which were managed with aseptic dressings along with air beds and increased mobilization. Only 4% had medialization of shaft for which delayed weight bearing was followed, which eventually showed union by 22 weeks. Their most important finding as regards outcome was that no implant-related complication like lag screw cut-out or side plate pull out was reported [17].

One limitation to our study was that there was relatively small number of patients, which may have a negative effect on the level of the evidence. All the patients were slightly younger than patients in other studies with the maximum age of 72 years old. Thus, the bone quality of the patients may be stronger than of other studies, so can resist failure. However, we aimed to introduce a suggestion not a strong recommendation.

CONCLUSION

Locking DHS plate technique significantly merits in treating trochanteric femur fractures in terms of lower complication rate and maintenance of reduction especially in osteoporotic patients. Locking DHS plate for trochanteric femur fractures is a good option in elderly patients.

Mobilization and early functional results are good to satisfactory. The sooner the operation done the better is the results regarding functional and anatomical outcome in addition to time of union.

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