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ORIGINAL ARTICLE

Different treatment modalities of unstable peritrochanteric fractures; case series

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ABSTRACT

Keywords: unstable peritrochanteric femur fractures, Gamma nail (PFN), Dynamic hip screw.

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Background: Peritrochanteric femoral fractures are considered one of the challenging health problems in geriatrics. **Objective**: To compare the operative outcomes of treatment (DHS vs Gamma nail) of unstable peritrochanteric femoral fractures. **Methods**: This is a case series conducted on patients presented to orthopedic department with unstable peritrochanteric fracture between June 2020 and December 2021. Sixty patients included in this study. The patients were classified into two groups each group contains 30 patients, Group A (patients with peritrochanteric fractures treated with DHS) and Group B (patients with peritrochanteric fractures treated with Gamma nail). **Results**: The difference between Gamma group and DHS group regarding Parker mobility score was highly statistically significant after 1.5 MD [95% CI] -0.49 [-0.78 - -0.21] p-value < 0.01 and highly statistically significant after 3 MD [95% CI] -0.78 [-1.06 - -0.48], p-value < 0.001, while there was no statistically significant difference after 6 and 12 months. **Conclusion**: treatment options of unstable peritrochanteric fractures Gamma nail and DHS are considered the standard options for these fractures . This study shows that Gamma nail is safe and reliable modality in the management of peritrochanteric fractures.

INTRODUCTION

Peritrochanteric femoral fractures are considered one of the challenging health problems in geriaterics (1).These fractures are associated with increased disability and mortality and a decreased quality of life (2). Mechanical stability is very crucial in the management of these fractures to allow early mobilization . Early mobilization is essential to decrease morbidity and postoperative complications associated with these fractures (3,4)

Intertrochanteric fractures are classified by AO/OTA as 31A3. They are often called reverse oblique fractures.These are true intertrochanteric fractures. The fracture line passes between the two trochanters, above the lesser trochanter medially and below the crest of the vastus lateralis laterally. Both femoral cortices are involved.

This fracture type is subdivided:

- 31A3.1 – Simple oblique fracture
- 31A3.2 – Simple transverse fracture
- 31A3.3 – Wedge or multifragmentary fracture (7)

Nowadays, Most hip fractures are treated by extramedullary or intramedullary implants, which allow a stable fixation in the majority of cases (5,6). Generally, Gamma nail and dynamic hip screw (DHS) internal fixation are the main options, the intramedullary nail such as gamma nail appears to have theoretical advantages over the DHS in the management of peritrochanteric

fractures as lesser surgical trauma biologically and greater strength biomechanically (7,8). The optimal management of peritrochanteric fractures remains controversial. Minimally invasive techniques are usually preferred by most surgeons . Frequent modifications in the design of intramedullary fixation modalities make them more preferable and reliable than extramedullary fixation modalities (8)

M Zlowodzki and parker believes that Gamma nail is a promising alternative technique especially for the comminuted peritrochanteric fractures with subtrochanteric extension. (8,9)

The current study aims to evaluate operative functional outcomes and radiological outcome after treatment options of unstable peritrochanteric fractures .

PATIENTS AND METHODS

This is a case series conducted at Trauma & Orthopedics department, between June 2020 and December 2021. The protocol of the study was approved by IRP, Faculty of Medicine, Aswan University. and included 60 patients with peritrochanteric fracture, 30 in each group. Patients included in the study were randomized into two groups:

- Group A: patients with peritrochanteric and treated by DHS surgery.
- Group B: patients with peritrochanteric and treated by Gamma nail.

Numbers were generated by the computer. The allocations were contained in opaque, sequentially numbered sealed envelopes.

The study included patients aged >18 years with peritrochanteric femoral fracture (32-C1.1\A.O classification) indicated for surgery presented to the hospital between June 2020 and December 2021 . No specific gender included. Patients aged less than 18 years, unfit for surgery or had an active infection were excluded from surgery .Comorbidities were infection , vascular injury, delayed union & non-union.

Patients were identified and full history taking were done including personal history (such as age, gender, mode of trauma) and past history (any comorbidities). Radiological investigations such as plain x-ray(A.P view & lateral view) and CT scan were made for comminuted type and x-ray on traction table .

Operative technique:

DHS

In group A, all patients underwent surgery on traction tables in the supine position. 5cm incision were made above the greater trochanter. DHS, lag site was assessed by fluoroscopic control & plate were slid below the muscle tissue across the fracture site from the incision. All fracture were reduced with closed techniques, frontal alignment was assessed using the cable technique and rotational alignment was determined by assessing the shape of the lesser trochanter under fluoroscopy, leg length disparity was avoided by comparison with the uninjured leg.

The Lag screw and plate was inserted through a lateral approach , which was positioned by using the image intensifier. . The all cases use implant was the 135-degree**,** three-hole plate.(7**)**

Gamma nail

In group B, patients were placed in the supine position on traction table were 5 **cases** and in lateral position were 25 cases , appropriate lag screw length , site & nail length were determined intraoperatively under fluoroscopic control of the femur.(9)

Postoperative care: Patients were transferred after the operation to the recovery room and then to the trauma and orthopedics department for early recovery and intermediate or intensive care for late recovery.

1. Intravenous (I.V) fluids, gram+ve antibiotics(cephalosporin) were administered.
2. Strong analgesic was used and in severe pain was given.

Follow up:

Includes clinical and radiological evaluation at 0 , 1 ,6 and 12 months. Evaluation of fracture stability , union rate and return to daily activities guided by Parker mobility score .

Statistical analysis

The collected data was revised, coded, tabulated, and introduced to a PC using Microsoft excel. All statistical analysis were done using **SPSS 25.** Data was presented and suitable analysis was done according to the type of data obtained for each parameter. According to the type of data, qualitative data represent as number and percentage, quantitative data represent by mean ± SD. P-value was considered significant if it was < 0.05.

RESULTS

There was no difference in gender distribution. Moreover, the about 50% of patients didn't have any comorbidity, and the most common comorbidity was cardiac disease and DM. the most common mode of trauma was fall on the ground, which explained by the high age of the included patient, while RTA was a leading cause. Moreover, only one patient due to fall from height and one was pathological.

The Mean ± SD age for DHS group was 62 ± 10 while for gamma nail group was 59 ± 21. Regarding to the blood loss the mean ± SD for DHS group was 376.7 ± 59.8, while for gamma nail group was 298.3 ± 114.1.

The mean ± SD Operative Time for DHS and gamma nail groups was 105.8 ± 9.17 and 91.4± 9.9,(minutes) respectively. Moreover, the mean ± SD Hospital stay for DHS group was 6 ± 3.3, and for gamma nail group was 6 ± 2.3(days) regarding to Time to union, the mean ± SD Time to union for DHS group was 3.7 ± 0.6, while that of gamma nail group was 3.4 ± 0.8.(months). (Table2)

Regarding the intra-operative blood loss, the amount of blood loss was highly statistically significant difference between the two group MD [95%] 78.3 [30.9- 125.73] cc, p-value <0.01.

Regarding the operative duration, the duration of DHS operation has very highly statistically significant duration more than Gamma group, MD [95%] 14.33 [9.39- 19.27] minutes, p-value <0.001.

As regard to the duration of hospital stay, the Gamma group had a non-statistically significant hospital stay duration in comparison to DHS group MD [95% CI] - 0.03 [-1.48 - 1.41] days, p-value > 0.05.

Mean time of weight bearing in DHS group was 1.82 ± 0.56 months while in Gamma group was found to be 1.23 ± 0.27 months , P value 0.566

The Gamma group does not statistically significant differ from DHS group regarding time to union MD [95% CI] 0.23 [-0.16 - 0.63] months, p-value > 0.05.

Parker mobility score (PMS) is used to evaluate functional results between 2 groups as regard return to daily activities. The difference between Gamma group and DHS group regarding PMS was highly statistically significant after 1.5 MD [95% CI] -0.49 [-0.78 - -0.21] p-value < 0.01 and very highly statistically significant after 3 MD [95% CI] -0.78 [-1.06 - -0.48], p-value < 0.001, while there was no statistically significant difference after 6 and 12 months. (**Table 4**)

Infection rate was found to be (2.23 % among group A and 1.69% among group B , P value .065).

Metal failure rate was found to be (3.25% among group A and 2.11% among group B , P value 0.236)

DISCUSSION

Regarding the operative duration, the duration of DHS operation (105.8 minutes) has very highly statistically significant duration more than Gamma group (91.4 minutes), MD [95%] 14.33 [9.39- 19.27] minutes, p-value <0.001. Operative duration in Gamma nail ranged from 75 to 115 minutes, while in DHS group, it ranged from 87 to 125 minutes, this might be explained by the

increase of learning curve and hand skills of the surgeons. Similar to our work, Butt and Chua reported that the mean difference of operative duration between DHS and Gamma groups was 9 and 10 minutes (15,16), respectively. Against to our work, Bridle, Parker, Verettas, Warren and Kukla found that the mean difference in operative duration was 0.5, 1, 2, 2 and 6 minutes (17–21). On the other hand, Yeganeh and Aktselis found that the mean difference in operative duration was 30 and 25 minutes (13,22).

In the current study we found that the amount of blood loss in Gamma group was highly statistically significant lesser than DHS group MD [95%CI] 78.3 cc [30.9- 125.73], p-value <0.01. In line with our results Verettas reported that the difference in blood loss was 50 cc (12), and Yeganeh found that the difference was 120 cm (13). On the other hand butt reported that the mean difference was 14 cc (4). also, Kukla found the mean difference was 8 cc (14). moreover, Bridle reported that the difference was 21 cc (2).

As regard to the duration of hospital stay, the Gamma group (5.97 days) had a non-statistically significant decrease in hospital stay duration in comparison to DHS group (6 days) MD [95% CI] - 0.03 days [-1.48 - 1.41], p-value > 0.05, given that the mean age for DHS and gamma nail groups are 62 years and 59 years respectively. In a study conducted by Yeganeh the mean difference in duration of hospital stay was 5.3 days for DHS group and 5.58 days for gamma nail group (13) which looks similar to our study in terms of overall mean hospital stay for the study participants which could be explained by similar mean age for both studies unlike other studies such as (23) in which the mean hospital stay is (DHS=16 , gamma = 17) and the mean age is (DHS = 82 , gamma =82) (Table 5)

Infection is the most common complication among our cases (2.23 % among group A and 1.69% among group B) , most cases were treated by wash, debridment ,culture and shift to suitable antibiotics . Only one case in group A needed early metal removal and external fixator. Metallic failure rate was found to be 3.25% among group A and 2.11% among group B , P value 0.236 . Two cases needed DHS removal and revised using gamma nail while only one case needed gamma nail removal in group B and treated with another longer gamma nail.

Although we focused a lot in this study about technical differences between DHS and gamma nail and we provided adequate functional comparison between both options ,we are planning to continue this study with bigger sample size because the current sample size is considered small with this common fractures .

CONCLUSION

Gamma nail is a safe option to treat peritrochanteric fractures. It offers more stable construct in unstable fractures than DHS . It has lesser operative time, lesser blood loss and comparable results regarding the time to union and hospital study.

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Conflict of Interest: The Authors declare that there is no conflict of interest.

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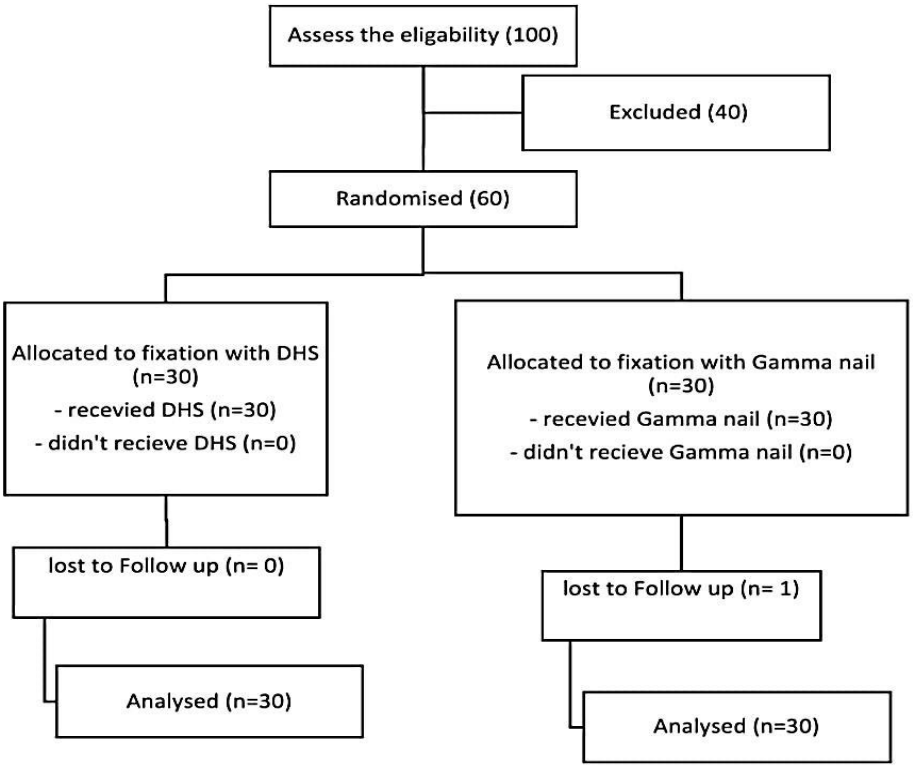

Chart (1) : Consort Flow chart

		DHS		Gamma	
		Count	%	Count	%
Gender	Male	16	53.33%	18	60.00%
	Female	14	46.67%	12	40.00%
Comorbidity	No comorbidities	15	50.00%	16	53.33%
	Cardiac	3	10.00%	5	16.67%
	DM	6	20.00%	1	3.33%
	Chest Infection	0	0.00%	1	3.33%
	HTN & DM	3	10.00%	2	6.67%
	HCV	3	10.00%	2	6.67%
	HTN	0	0.00%	2	6.67%
	Hypothyroidism	0	0.00%	1	3.33%
Mode of trauma	FOG	24	80.00%	21	70.00%
	RTA	6	20.00%	7	23.33%
	Fall from height	0	0.00%	1	3.33%
	Pathological	0	0.00%	1	3.33%
Limb affected	Right	21	70.00%	17	56.67%
	Left	9	30.00%	13	43.33%

Table 1:Demographic data of categorical data

	DHS	Gamma
	Mean ± SD	Mean ± SD
Age (years)	62 ± 10	59 ± 21
Blood loss (cc)	376.7 ± 59.8	298.3 ± 114.1
Operative Time (Minutes)	105.8 ± 9.17	91.4± 9.9
Hospital stay (days)	6 ± 3.3	6 ± 2.3
Time to union (Months)	3.7 ± 0.6	3.4 ± 0.8

Table 2:Demographic data of numerical variables

	DHS	Gamma	Mean Difference [95% CI]	p-value
Blood loss (cc)	376.67	298.3	78.3 [30.94 - 125.7]	< 0.002
Operative Time (minutes)	105.8	91.4	14.33 [9.39- 19.27]	< 0.001
Hospital stays (Days)	5.97	6	- 0.03 [-1.48 - 1.41]	0.963
Time to union (Months)	3.68	3.45	0.23 [-0.16 - 0.63]	0.233

Table 3:Comparison between Gamma and DHS regarding operative and post operative outcomes.

	DHS	Gamma	Mean Difference [95% CI]	p-value
	Mean ± SD	Mean ± SD		
PMS after 1.5 months	2.3 ± 0.46	2.79 ± 0.62	-0.49 [-0.78 - -0.21]	< 0.01
PMS after 3 months	3.5 ± 0.51	4.28 ± 0.59	-0.78 [-1.06 - -0.48]	< 0.001
PMS after 6 months	5.4 ± 0.62	5.66 ± 0.73	-0.26 [-0.6 - 0.09]	> 0.05
PMS after 12 months	6.3 ± 0.79	6.76 ± 0.69	-0.46 [-0.85 - -0.07]	> 0.05

Table 4 : Parker mobility score results

Author	Intervention	Male	Sample size	Mean Age	Operative time	Blood loss	Hospital stay
Our Results	DHS	16	30	62	105.8	376.7	6
	Gamma	78	30	59	91.4	298.3	6
(Aktselis et al., 2014)	DHS	7	35	83	75.5	NR	16.4
	Gamma	8	36	82.9	45.7	NR	16.6
(Verettas et al., 2010)	DHS	15	59	81	45	200	10.3
	Gamma	20	59	79	42	150	10.2
(Butt et al., 1995)	DHS	13	48	78	62	190	23
	Gamma	16	47	79	53	176	22
(Kukla et al., 1997)	DHS	4	60	84	53.4	160	14
	Gamma	14	60	83	47.1	152	15
(Bridle et al., 1991)	DHS	7	51	82.7	42.5	141	NR
	Gamma	9	49	81	43	162	NR
(Yeganeh et al., 2016)	DHS	NR	65	63.5	74	370	5.3
	Gamma	NR	75	66.7	50	248	5.58
(Martyn J. Parker, 2017)	DHS	116	500	82	44	NR	16
	Gamma	112	500	82	45	NR	17
(Warren et al., 2020)	DHS	2643	8505	80	56.36	NR	7.54
	Gamma	2576	8505	80	54	NR	7.28
(M. J. Parker & Cawley, 2017)	DHS	47	200	83	42	NR	15.3
	Gamma	60	200	82	38	NR	15.9
(Chua et al., 2013)	DHS	18	38	77	85	NR	11
	Gamma	13	25	75	75	NR	12

Table 5:Comparison between our results and literature

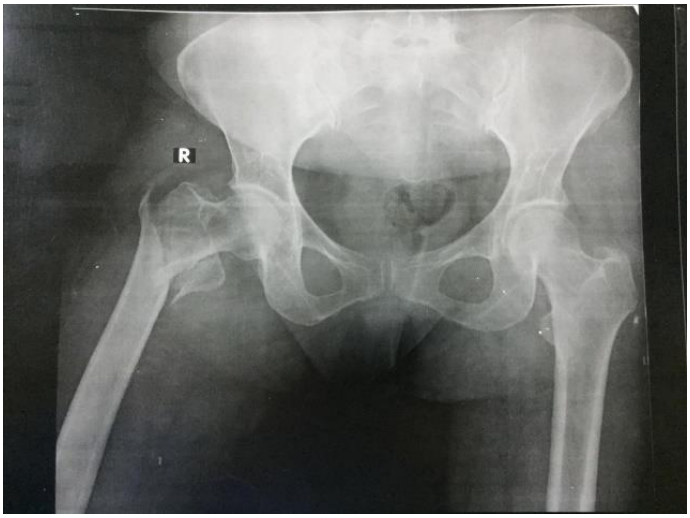

Figure 1: 60 year-old male with trochanteric fracture Pre-op. x ray

Figure 2: Post-op. x ray by DHS fixation

Figure 3: one year -Follow up. x-rayes afer union with fixation by DHS

Figure 4: 73 year-old patient with trochanteric fracture

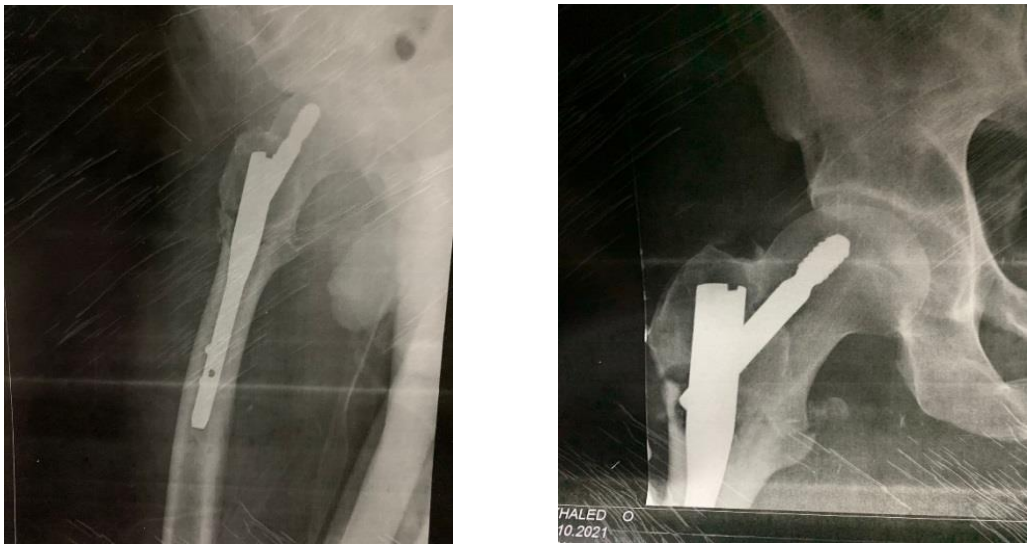

Figure 5: post-ope. x-rayes fixation by gamma nail

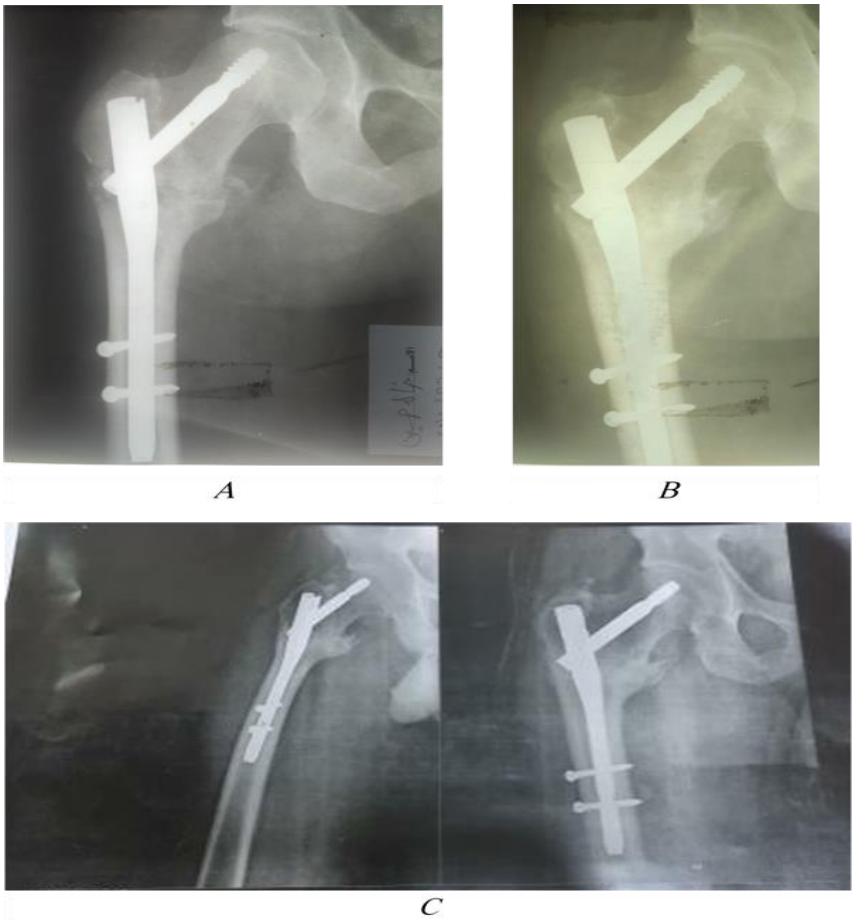

Figure 6 :post-operative follow up x-ray.

A:after 1 month , B :After 3 months, C after 12 months