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EVALUATION OF NECK SHAFT ANGLE AS A PREDICTOR OF CUT-OUT FAILURE IN PERTROCHANTERIC FRACTURES- AN OBSERVATIONAL STUDY

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ABSTRACT **Introduction:** Femoral trochanteric fractures are extremely common fractures of old age. Due to the fracture, there is a change in the neck shaft angle (NSA) which if not restored can lead to further disability [1]. In this study, we aim to evaluate the neck shaft angle as a predictor of cut out failure in patients with pertrochanteric fractures after surgical fixation by various fixation methods. Materials and methods: A total of 100 patients with pertrochanteric fractures were enrolled in the study, who underwent surgical fixation with either of three 3 methods- DHS/PFN/PFN-A. Patients were followed up at 6 weeks, 3months and 6 months. Neck shaft angle (NSA) of the normal side was calculated on pre-operative x-rays and of affected side on post operative radiographs. Results: The mean NSA of normal side (N) and operated side (O) across various fixation methods in our study was as follows- DHS- Normal side(N)-127.890, Operated side(O)- 130.80; PFN- N-126.60, O-128.50; PFN-A- N-126.330, O-127.40. In all three groups, the fracture was fixed in valgus position. 6 cases of cut-out failure observed in the study, 4 among the DHS group and 2 among the PFN group. The mean NSA on operated side, mean difference between normal and operated side, change at 6 weeks, 3 months and 6 months was significantly more among DHS group compared to PFN and PFN-A groups.

KEYWORDS : Pertrochanteric Fractures, DHS, PFN, PFNA, NSA.

INTRODUCTION:

Orthopaedicians and Radiologists use the normal range and mean values of the neck shaft angle in the diagnosis and treatment of various affections of the hip. The angle of femoral neck is reduced with aging. In early infancy the neck shaft angle is about 150°, in childhood 140°, in adult about 125° and in elderly about 120°[2,3].

Demographic development has resulted in an increased incidence of geriatric fractures. Unstable patterns around proximal femur occur more commonly with increased age and with low bone mineral density. The fracture commonly occurs through bone affected by osteoporosis. The gold standard for the treatment of intertrochanteric fractures is surgical [4]. These fractures can be surgically managed with sliding hip screw-plate construct, cephalomedullary nailing or arthroplasty depending on fracture and patient characteristics, with the first two options being the standard surgical treatment methods chosen by most surgeons [5]. The aim of treatment of femoral trochanteric fractures is a rigid fixation and restoration of the NSA to as near as normal, to allow early mobilization of the patient.

In general a varus displacement of 3.9° to 5.3° within the first six weeks after surgery compared to initial postoperative measurements is a common finding. This suggests that an optimal fracture reduction should be performed in a slightly valgus position [6].

Materials and Methods:

A total of 100 patients with pertrochanteric fractures presenting to Maharishi Markandeshwar Institute of Medical Sciences and Research (MMIMSR), Mullana-Ambala from March 2020 were enrolled in the study. All patients were subjected to relevant investigations after which they were taken up for surgical fixation of the fracture with either DHS/PFN/PFNA. Patients were followed up at 6 weeks, 3 months, and 6 months and post operative radiographs were obtained on which neck shaft angle was measured.

RESULTS:

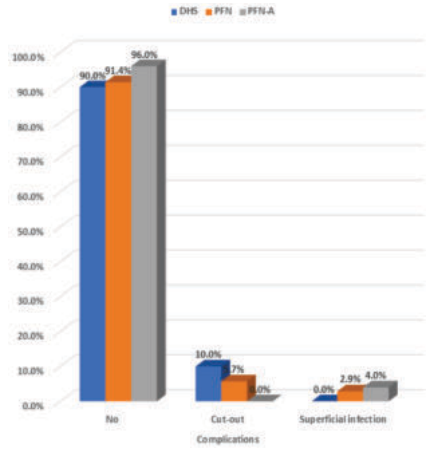
The study population had a total of 100 patients and constituted of 58 females and 42 males indicating a female preponderance. The mean age of the study population was 59.31 $\pm$ 10.52 years with majority of the patients in the 61-70 years age group. While majority of female patients were in the 60-70 years of age group.

Table/ Figure 1: Demographics

	Value
Age (years)	
Mean	59.31
Range	22 to 70
Gender (n (%))	
Female	58 (58%)
Male	42 (42%)
Side (n (%))	
Right	52 (52%)
Left	48 (48%)
AO Type	31A2(54%)

Trivial fall was observed to be the most common mode of injury contributing to 88% of the total cases. Right sided fracture injuries were observed in 52% of the study population and left side fracture

injuries were observed in 48% of the study population. Cut-out was significantly more among DHS (10.0%). Superficial infection was found in 1 case each in PFN and PFN-A.



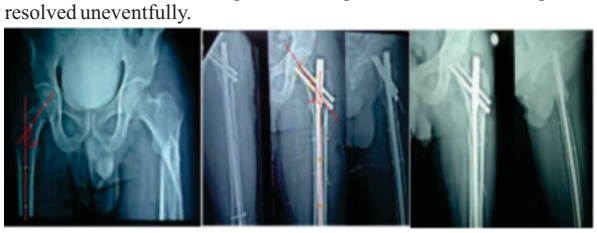
Table/Figure 1: Complications in DHS, PFN and PFN-A

The most common fracture pattern involved was AO Type 31A2 seen in 54% of the patients. The mean NSA was significantly more on the operated side compared to normal side in DHS group. In all three groups, the fracture was fixed in valgus position.

Table/Figure 2:Comparison of NSA between Normal and Operated side

	NSA	Mean	Std. Deviation	p-value
DHS	Normal side	127.89	2.66	0.001*
	Operated side	130.80	2.58	
PFN	Normal side	126.60	3.31	0.101
	Operated side	128.50	1.79	
PFN-A	Normal side	126.33	2.48	0.108
	Operated side	127.40	2.32	

There were 6 cases of cut-out failure observed in the study population of which 4 cases were from DHS group and 2 cases were from PFN group. No cut out was observed in PFN-A group. 3 cases were lost to follow up following complications. 2 cases of post operative superficial infection were reported, 1 in each PFN and PFN-A group which were treated with regular dressing and antibiotic coverage and resolved uneventfully.



Table/Figure 3: Pre-operative, Immediate Post-op, and 3 months Post operative X-rays

DISCUSSION:

In recent years, intramedullary nails have overtaken the dynamic hip screw as the most commonly used implant in the surgical fixation of intertrochanteric fractures, especially in unstable fractures [7,8]. This is supported by recent literature suggesting the superiority of cephalomedullary nails compared to sliding hip screw-plate constructs in terms of biomechanical stability and functional outcome, especially in unstable intertrochanteric fractures [9,10].

The most commonly reported complication in the internal fixation is the cut-out defined as "the collapse of the neck-shaft angle into varus, leading to extrusion of the screw from the femoral head" [11]. The influence of the neck-shaft angle of an implant on cut-out has been controversial.

DHS has been the considered the gold standard of intertrochanteric fracture fixation for a long time, especially for the stable fracture types. The PFN was designed to overcome implant-related complications of DHS and facilitate the surgical treatment of unstable intertrochanteric fractures as it, being an intramedullary implant, imparts a lower bending moment, compensates for the function of the medial column and acts as a buttress in preventing the medialization of the shaft [12].

These fractures commonly occur in the elderly age groups and osteoporotic bones. In this study the mean age of study population was 59.31 $\pm$ 11.11 years. In the present study, 58% of the study population were females, which is comparable to the existing literature, owing to early osteoporosis in the female population following an history of trivial fall as the most common mode of injury. In the present study also, in 88% of the patients the most common mode of injury was found to be trivial fall, followed by motor vehicle accident (12%). The most common fracture injury sustained by patients was classified into AO Type 31A2 which was observed in 54% of the patients. This compares favourably with other similar studies conducted previously. Among all 3 groups, the mean NSA was more on the operated side compared to normal side. The mean NSA on Operated side, mean difference between normal and operated side, change at 6 weeks, change at 3 months and change at 6 months was more among DHS group compared to PFN and PFN-A groups.

Cut-out was significantly more among DHS (10.0%). Superficial infection was found in 1 case each in PFN and PFN-A. Cut-out occurred among 4 subjects in DHS group and 2 in PFN group. All cut outs, irrespective of the implant used were seen cases where fractures were fixed in varus. Of these 2 cases under went total hip arthroplasty and 1 case underwent hemi arthroplasty, and 3 were lost to follow up.

CONCLUSION:

Neck shaft angle is an important factor to prevent cut out in any fixation method. We conclude the cut out in various fixation methods can be reduced by meticulous pre operative evaluation, adequate management of osteoporosis, proper reduction, achieving neck shaft angle as close to normal side as possible and proper placement of screws according to Cleveland zones.

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