

# Measurement of Tip Apex Distance and its Relation with Cut-Out After Fixation of Proximal Femoral Fractures with Dynamic Hip Screw or Proximal Femoral Nail

## A Retrospective Longitudinal Analysis of 106 Patients

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### Abstract:-

#### ➤ Purpose:

To synthesize evidence between tip apex distance and screw cut-out after fixation of proximal femur fractures by dynamic hip screw or intra medullary nail. **Methods:** A retrospective cohort study of one hundred and six patients from January 2021 till December 2021. Patients who had fracture proximal femur managed using a dynamic hip screw or intramedullary nail were included in this study. A minimum of six months follow up in mandatory for including patients as well. We excluded patients who had fracture proximal femur managed by other modality.

#### ➤ Results:

Three patients complicated with screw cut-out, and required conversion to hemiarthroplasty, while one patient had a fall and experienced a fracture required plate fixation. One patient converted to total hip replacement due to non-union. The tip apex distance of the failed patients were (32, 30, and 33) Two were fixed by Dynamic hip screw (DHS) while one was fixed by Proximal femoral nail (PFN).

#### ➤ Conclusion:

Tip Apex Distance is a reliable indicator for predicting screw cutting in intertrochanteric fractures treated with Dynamic Hip Screw or Proximal femoral nail.

**Keywords:-** Dynamic hip screw; Intramedullary nail; Fracture proximal femur; Tip apex distance; Screw cut-out.

## I. INTRODUCTION

Unstable proximal femoral fractures are common and a challenge for orthopedic surgeons. The goal of surgical treatment of these fractures is stable fracture fixation that allows early loading. Although many different devices have been developed, mechanical failures still occur [1]. The dynamic hip screw is the preferred method for treating

intertrochanteric fractures because it allows controlled impaction of the fracture to achieve a stable position while maintaining a constant neck and trunk angle [2]. Nevertheless, mechanical failure of this device is reported to be 25%. The most common type of failure is a broken screw or blade. There are various factors that lead to implant cutouts like Patient age, bone quality, fracture pattern, reduction stability, implant angle, and lag screw position [3,4].

When using the sliding hip screw and plate construct, a tip-to-apex distance (TAD) “Fig 1” of less than 25 mm and center-center location has been shown to be an important factor in minimizing the risk of cutout [5]. There are few correspondent data regarding the optimal placement of intramedullary devices such as proximal femoral nail (PFN). The Tip Apex Distance is calculated from the sum of the distance in millimeters, from the tip of the lag screw to the femoral head apex, in both the anterior-posterior radiograph and the lateral radiograph [6].

We conducted this study to synthesize evidence between the tip apex distance (TAD) and screw cut-out.

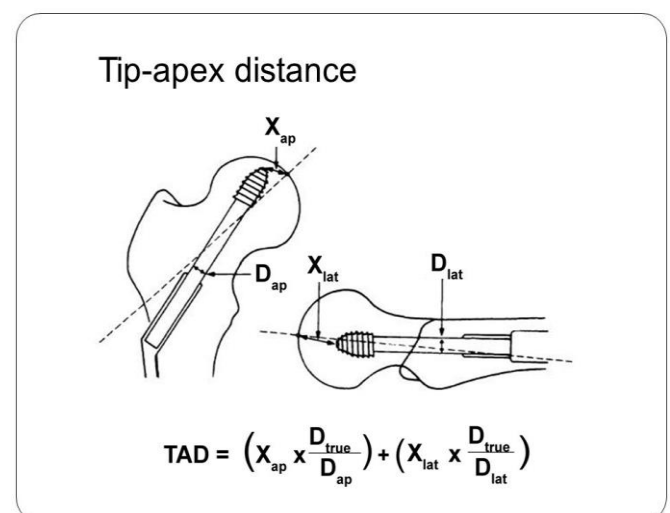


Fig 1:- TAD measurement Equation.

**II. METHODS**

*A. Study design*

This study was conducted in cooperation between Sinai-clinic hospital and King Abdullah university hospital. The IOS and I-Soft databases were used to perform a retrospective cohort of patients who underwent proximal femoral fracture fixation between the periods from January 2020 till January 2022. All analyses were conducted using Jamovi 2.2.5 for windows.

*B. Inclusion and Exclusion criteria*

All intertrochanteric fractures treated with Dynamic Hip Screw or proximal femoral nail. Radiological and clinical follow up had to be available for at least Six months or should have documented early failure. We excluded Intertrochanteric fractures treated with other modality.

**III. RESULTS**

Extensive search for patients that meets our inclusion criteria in our database retrieved one hundred and six patients. Out of these, seventy two were females and thirty four were males “Table 2”. The age of patients was variable, youngest patient included was 51 year old and the oldest 103 year old with the mean age of 80.24, and the Standard Deviation for age was 11.53 “ Table 1”. The side of fracture was evenly disturbed on both side, 56 was on left side and 50 on the right “Table 3”. Majority of patients were managed using DHS (seventy one patients, while the remainder of patients (thirty five) undertook a Proximal Femur Nail fixation “Table 4”.

Our result concluded: TAD-AP maxed at 23 while the minimum was 3. Mean stands at 8.26 with a SD of 3.79.

With a SD of 3.61 the mean for TAD-lat was 8.39 with a maximum value of 24 and minimum of 3. TAD highest end of the scale was 35 while the lowest 6, mean for TAD in the 106 patients was 16.56 with a SD of 6.69. Mean for the Angles was 131.94 while the widest angle was 135 and the narrowest was 125, SD of 3.86 for this data. “Table 1”. In the Post Op follow up period, majority of patients 94.3% (99 patients) did not suffer from any surgical complications that needed any further complications. However, three of the patients had cut out, a single patient suffered from non-union and needed conversion to THR, one patient required removal and one patient suffer from miscellaneous greater trochanter complications, all of these complications composed 3% (1% each)” Table 5”.

Levels	Counts	% of Total	Cumulative %
F	72	67.9 %	67.9 %
M	34	32.1 %	100.0 %

Table 2:- Frequencies of GENDER

Levels	Counts	% of Total	Cumulative %
L	56	52.8 %	52.8 %
R	50	47.2 %	100.0 %

Table 3:- Frequencies of SIDE

Levels	Counts	% of Total	Cumulative %
DHS	71	67.0 %	67.0 %
IM Nail	35	33.0 %	100.0 %

Table 4:- Frequencies of Fixation

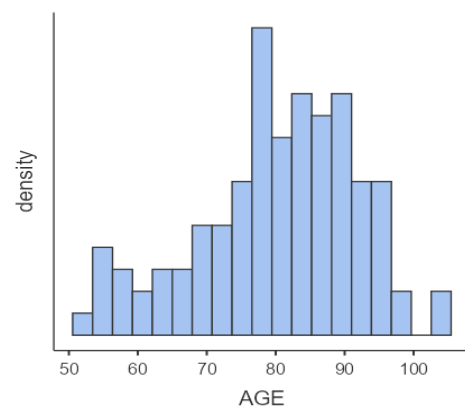


Fig 2:- Bar plot of Age distribution of the included patients

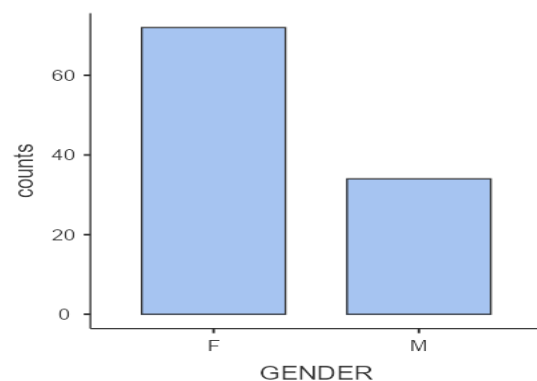


Fig 3:- Bar Plot of gender distribution.

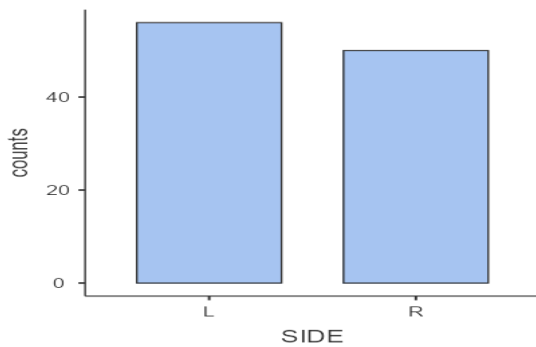


Fig 4:- Bar Plot of fracture side of included patients.

#### IV. DISSCUSION

In the literature, there is still controversy about the optimal treatment strategy for different types of proximal femoral fractures [7]. The intramedullary and extramedullary strategies were analyzed according to biomechanical and functional aspects as well as the rate of mechanical failures [8]. Regarding the tip apex distance, some authors have determined a maximum prognostic value of 25 mm to prevent postoperative complications such as implant failure [9,10]. Cut-out failure has been identified as one of the most important mechanical complications after intramedullary and extramedullary therapy with rates ranging from 1.4% to 19% depending on fracture type and implant used [11,12].

In our study of one hundred and six intertrochanteric fractures treated with dynamic hip screw or PFN, there was an average age distribution eighty years with thirty four males and seventy two females. Most common cause was trivial fall. The average tip apex distance for all the fractures was 16.56 (Range 6 – 35mm). There were three screw cut outs whose tip apex distances were 32, 30, and 33 mm. Regarding our good clinical outcomes, most values were superior to this prognostic value, as shown in the charts” Fig 2,3 and 4”.

#### V. CONCLUSION

From our study, it can be concluded that Tip Apex Distance is a reliable indicator for predicting screw cutting in intertrochanteric fractures treated with Dynamic Hip Screw or proximal femoral nail.

There may be other factors involved in the development of this type of complication. As far as we are concerned, new prospective randomized trials may be useful to find a more causes of screw cutoff.

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	N	Missing	Mean	Median	SD	Minimum	Maximum
AGE	106	0	80.24	81.00	11.53	51	103
TAD-AP	106	0	8.26	7.50	3.79	3.00	23.0
TAD-Lat	106	0	8.39	8.00	3.61	3.00	24.0
TAD	106	0	16.56	15.00	6.69	6.00	35.0
Angle	106	0	131.84	135.00	3.86	125	135

Table 1:- Descriptive of study population

Levels	Counts	% of Total	Cumulative %
CUT OUT	3	2.9 %	2.9 %
Converted to THR, non-union	1	1.0 %	3.8 %
GT fracture following a fall	1	1.0 %	4.8 %
NONE	99	94.3 %	99.0 %
REQUIRED REMOVAL	1	1.0 %	100.0 %

Table 5:- Frequencies of Complication

	N	Missing	Mean	Median	SD	Minimum	Maximum
TAD	106	0	16.56	15.00	6.69	6.00	35.0
TAD-AP	106	0	8.26	7.50	3.79	3.00	23.0
TAD-Lat	106	0	8.39	8.00	3.61	3.00	24.0

Table 6:- Descriptive of TAD, TAD-AP and TAD-Lat