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To study correlation between the tip apex distance and the functional outcome of fracture intertrochanteric femur treated with trochanteric femoral nail

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Abstract

Introduction: Tip Apex Distance (TAD) is well established method of prediction of outcome in intertrochanteric fractures managed by Dynamic Hip Screw. This retrospective study was done to assess the significance of Tip Apex Distance in the management of the intertrochanteric fractures by proximal femoral nail.

Methodology: Selection of Cases-An informed written consent will be taken from all the patient/relatives/guardian after the approval of Institutional Ethics Committee.

Source of Data: Patients admitted to Sri Aurobindo Medical College and PG Institute, Indore for fracture proximal humerus in adult patients.

Conclusion: This study indicates that the Tip Apex Distance can be used as a useful predictor of the outcome of the proximal femoral nail in intertrochanteric fractures.

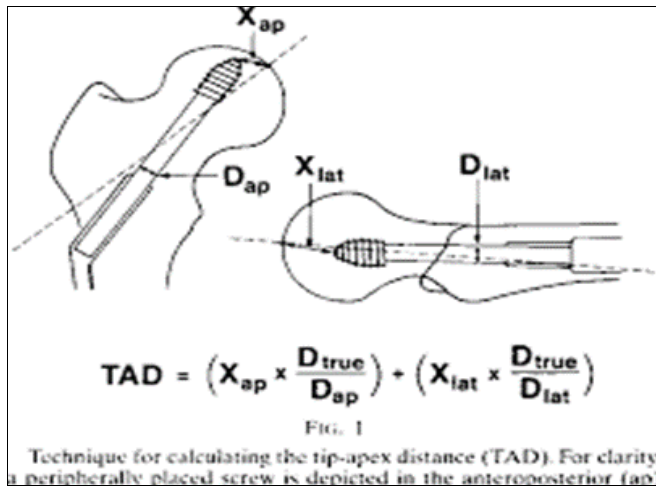
Keywords: Proximal femur nailing Intertrochanteric fracture Tip apex distance Harris hip score Lower extremity functional scoring system Neck shaft angle

Introduction

Intertrochanteric fractures in patients are common and generally caused by low-energy injuries, such as falls. The average age in these patients is reported to be 66-76 years with female preponderance. Female to male ratio ranges from 2:1 to 8:1. Decreasing bone density after menopause may be a contributory factor. They are often associated with some degree of osteoporosis and the different treatment methods available emphasize the difficulties in managing these injuries. The surgical treatment aims to achieve union in a good position with a low morbidity and to facilitate early return of the patient to his/her pre fracture activity. If prior to injury, patient was bedridden then goal of treatment is pain relief and better nursing care.

Tip Apex Distance

Baumgartner *et al*, initially came up with the concept of Tip Apex Distance in 1995, and later in 1997 confirmed the importance of good surgical technique in the treatment of trochanteric fractures using the TAD as a clinically useful way of describing the position of the screw. The tip apex distance (TAD) should be less than 25 mm to prevent cut-out or failure, which most often happens if the screw is placed too anterior or too superior. The TAD is the sum of the distance from the tip of the screw to the apex of the femoral head on AP and lateral views. A compromise may be accepted in slightly posterior and inferior positions, if difficulties are encountered, as these positions have less association with screw cut-outs, compared to superior and anterior placement of the screw, which are associated with a high cut-out rate.



Our Study

1. To study correlation between the tip apex distance and the functional outcome of fracture intertrochanteric femur treated with trochanteric femoral nail.
2. To study the tip apex distance and HARRIS HIP SCORE at 3 months
3. To evaluate radiological union at 3 months

Inclusion Criteria

- Intertrochanteric femur fractures.
- Patient more than 40 years.

Exclusion Criteria

- Patient having any other injury.
- Open fractures.
- Patients with previous history of fracture in the same limb treated either conservatively or surgically.
- Patient not giving consent

Methodology

Selection of cases

An informed written consent will be taken from all the patient/relatives/guardian after the approval of Institutional Ethics Committee.

Source of data

Patients admitted to Sri Aurobindo Medical College and PG Institute, Indore for fracture intertrochanteric femur in adult patients

This retrospective study was conducted at a tertiary care centre from April 2021 to Sept 2022. It included follow up

patients in whom Standard Trochanteric Femoral nail (TFN) was done for IT fracture femur. Non-ambulatory patients having concomitant or pathological fractures or refusing to participate in the study or not having proper preop and postop X-rays were excluded from this study.

In all patients the standard Trochanteric femoral nail consisting of 2 screws for the femoral head, one being the 8 mm femoral neck screw and the other being the 6.5 mm hip pin. The 6.5 mm hip pin acting as the derotation screw.

30 patients were included in this study after the inclusion and the exclusion criteria were met. After a written informed consent the patients' clinical outcome was assessed using Harris hip score Radiological assessment was done via Tip Apex Distance (TAD) on the immediate postop X-rays. The TAD was measured in relation to the lag screw and not the derotation screw after correcting for the magnification. All the measurements in the TAD were made by a single observer

To avoid the confounding effect of patient's health status patients with any comorbid conditions, any long-standing non-ambulatory conditions, any associated fractures of femur or patients with pathological fractures were excluded from this study.

For evaluating the clinical outcome the Harris Hip Score and Lower extremity functional scoring system were used which has been widely used as the gold standard and has proved to be very reliable in several studies. The radiological and functional scores were calculated by a single observer to avoid any interobserver variation.

Only the follow-up cases of intertrochanteric fractures managed by trochanteric femoral nail were included in this study.

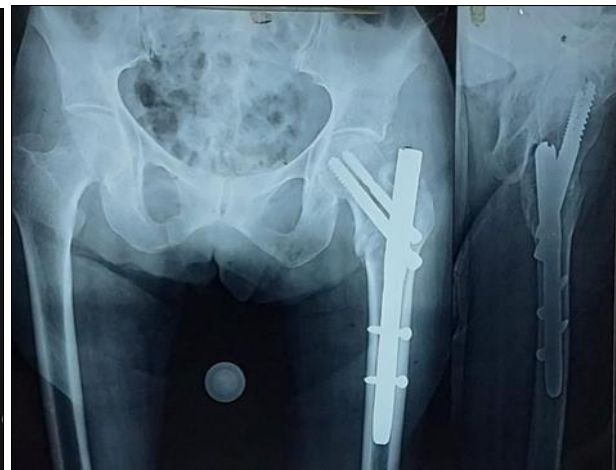
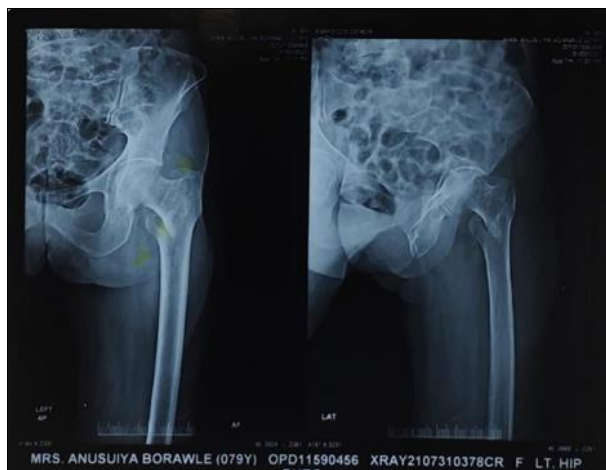
Study design

This is an observational retrospective and prospective study of all cases of fracture intertrochanteric femur treated with radiological outcome on follow up patients presenting in the Department of Orthopedics, Sri Aurobindo Medical College and PG Institute, Indore from April 2021 to September 202

Sample Size

This study will be feasible for a sample size of 30 patients. All patients with fracture intertrochanteric femur were classified by Boyd and Griffin classification treated using trochanteric femoral nail.

1. Total no of patient included in study 30.
2. Patient without screw cut out 30.
3. Patient with screw cut out 0.





TAD =TAD (AP) + TAD (LATERAL) =18.7 MM

Fig 1: Calculation of tip apex distance with a coin

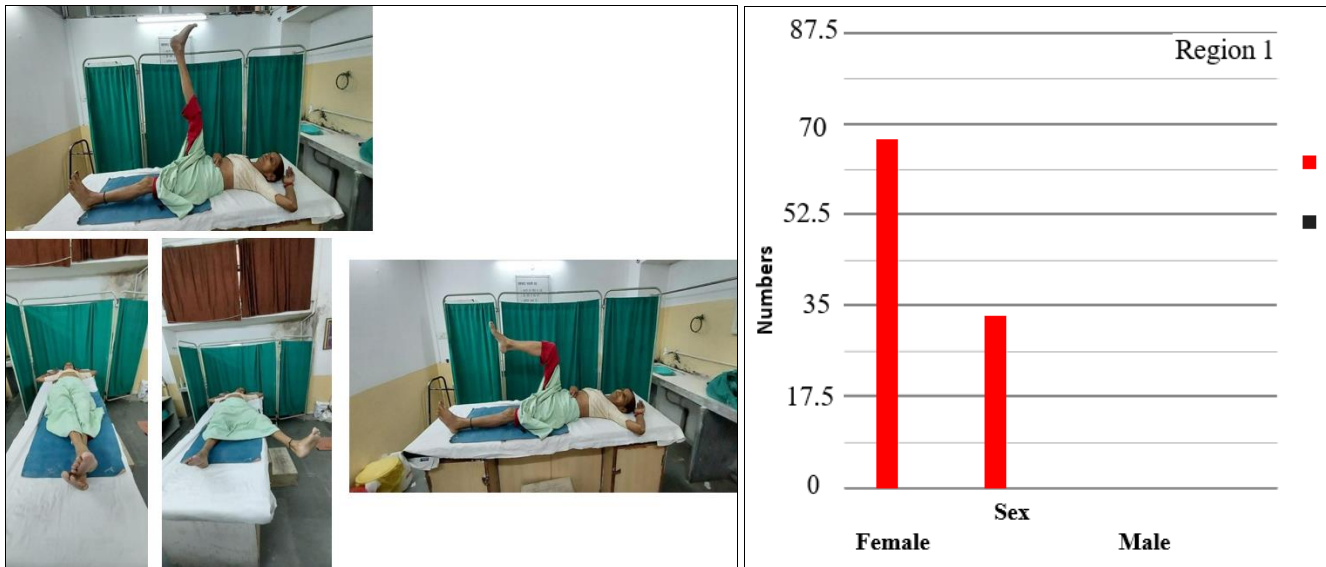


Fig 2: Bar graph showing incidence

Result

The study included 30 patients who had come for a follow up. The mean age of the patients included in the study was 60.86 years (45-68 years). The mean TAD was 21.04 mm (15-30). The average Harris Hip score was 87.66(70-90).

Discussion

Trochanteric femoral nail used consisted of 2 screws in the head. The mean age group in this study was found to be 68.86years. Intertrochanteric fractures are more common in the elderly with > 60 years of age. In slightly younger age group, which may have given better clinical results as

compared to the older population associated with Intertrochanteric fractures. Also, the quality of bone we were dealing with due to the lower age group might have given us better radiological outcome as well. The mean Tip apex distance was calculated as 21.04 mm in this study. This was comparable to various studies with the highest TAD found in Zirngibil *et al.* [1] (24.8) and the lowest mean value seen in Guven *et al.* [2].

The functional outcome was measured by the Harris hip score. The mean Harris hip score was found to be 87.66. This mean Harris hip score was comparable to various studies found in the literature as given

Table 1: Comparison between the mean average tip apex distance between the current and the references studies

Mode of Treatment	Guven <i>et al.</i>	Siwach <i>et al.</i>	Akan <i>et al.</i>	Uzun <i>et al.</i>	Tandon <i>et al.</i>	Present Study
TFN	-	-	73.58	82.1	86.6	87.66

Table 2: Comparison between the mean average tip apex distance between the current and the references studies

Mode of Treatment	Guven <i>et al.</i>	Geller <i>et al.</i>	Kraus <i>et al.</i>	Escolar <i>et al.</i>	Zirngibil <i>et al.</i>	Bruijn <i>et al.</i>	Uzun <i>et al.</i>	Present study
TFN	-	38	41.3	32.2	24.7	-	24.2	21.04

In the patients having uneventful healing of the fracture, it was seen that the TAD had a strong negative correlation with the functional scores hence, it was concluded that with the increase in the TAD, the Harris Hip Score decreased which is as per the search of the literature

This study shows that the criteria of Tip Apex distance while using proximal femoral nailing for the management of

intertrochanteric fractures is worthwhile and can be used as an intraoperative indicator for predicting the outcome of the fracture. The reason for calculating the TAD of the lag screw alone was that the other screw is just a derogation screw and the hold of the screw is not that significant.

There were a few limitations to this study. As it was a retrospective study there might have been a selection bias for

the procedure as some of the patients with unsatisfactory outcomes may not have come back for follow-up. Also, the radiological outcome observation may have been flawed as the foot might have been in a different rotation. The functional outcome may be altered due to the anxiety of the patient or due to the age of the patient as there was a slight correlation between the age and the functional outcome. Some

poor outcomes might have been lost due to follow-up.

Conclusion

This study shows that excellent score (90-100) was seen in tad between 20-25 mm, good score (80-89) in tad 15-20 mm and fair score (70-79) in tad 25-30 mm there were 2 patient having tad between 15-20 showed excellent harris hip score.

Table 3: Data of patients

S. No.	Sex	Age	Post of tad	3 month MDH score	3 month radiological union
1	F	66	21.1	90	Good union
2	F	63	24.1	96	Good union
3	F	45	23.7	94	Callus present
4	F	54	20	99	Good union
5	F	38	23.1	91	Good union
6	F	72	20.2	96	Callus present
7	F	45	20	98	Callus present
8	F	58	22	96	Minimal callus
9	M	62	22.5	92	Minimal callus
10	F	63	24.2	97	Good union
11	M	41	24.7	90	Good union
12	F	66	16.6	91	Good union
13	F	67	17	96	Good union
14	F	72	16.1	89	Good union
15	F	64	17	85	Callus present
16	F	62	20	87	Minimal Callus
17	M	66	19.1	89	Good union
18	M	71	18.5	80	Minimal callus
19	F	58	16.2	86	Callus present
20	M	60	19.3	87	Callus present
21	M	59	18.3	89	Callus present
22	M	66	15	83	Minimal callus
23	M	65	20.5	87	Callus present
24	F	64	19.3	82	Minimal callus
25	F	67	25.4	79	Callus present
26	F	66	26.1	70	Minimal callus
27	M	63	26.5	77	Callus present
28	M	63	24.3	79	Minimal callus
29	M	68	25.2	77	Callus present
30	F	52	25.5	78	Callus present

Recent Studies

Significance of Tip Apex Distance in Intertrochanteric Fracture femur managed with proximal femoral nailing AVikram Khanna^{ab} MukeshTiwari^b. The tip apex distance on the postoperative X-ray was found to be 22.93 + 3.88 mm. The Lower Extremity Functional Score was found to be 70.71 + 8.153. The Harris Hip Score was found to be 85.408 + 9.586. Change in the neck length as compared to the uninjured hip was found to be 1.46 + 1.705. Change in the offset and neck shaft angle was 1.38 + 1.567 and -2.61 + 1.27 respectively. There were 8 cases of screw cut out and 8 cases

of superficial infection.

The Harris hip score and the LEFS increased with decreasing values of the Tip Apex distance. The Neck shaft angle, Neck length and the *offset all* decreased with the increase in the Tip Apex Distance. The Harris hip score and the LEFS decreased with the decrease in the Neck shaft angle, Neck length and the offset. On examining the 2 groups one with TAD < 25 mm and the other with TAD > 25 mm it was seen that both functionally and radiologically, the outcome was better in the group having TAD < 25 mm.

Table 4: Harris hip score

Tad	No of PT	HHS
20-25	13	90-100
15-20	11	80-89
25-30	6	70-79

Conflict of Interest

Not available

Financial Support

Not available

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